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# 101 ENVIRONMENT FRIENDLY TECHNOLOGIES

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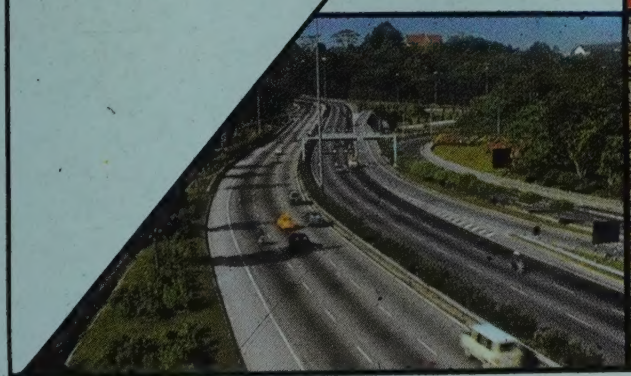
USING NEW TECHNIQUES

FOR SPECIFIC GAINS

IN SPECIAL SECTORS

USE FOR IN



ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY

New Delhi, INDIA

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14/1/97

# 101 ENVIRONMENT FRIENDLY TECHNOLOGIES

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**ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY**

Adjoining Technology Bhawan, Off New Mehrauli Road
Post Box No. 4575, New Delhi, INDIA

September 1993

**The Legend of the cover page as well as back page**

**FRONT COVER**

1. Environment friendly highway
2. A modern treatment plant
3. National flags of member countries
4. Solar water heater
5. Rice husk board in housing
6. Plant nutrition with feather complex fertilizer

**BACK COVER**

1. APCTT publications
2. Periodicals on display in APCTT Library
3. Inside view of the APCTT Library
4. Another view of APCTT Library
5. Information processing section
6. Exterior view of APCTT building

# PREFACE

The Asian and Pacific Centre for Transfer of Technology (APCTT) was established in 1977 at Bangalore, India. The Centre operates as a United Nations regional centre under the aegis of the Economic and Social Commission for Asia and the Pacific (ESCAP), Bangkok, Thailand. The statute of the Centre was adopted as the basis of the Centre's operation at the 41st session of the Commission of ESCAP in 1985. The Centre receives its overall direction from the annual sessions of ESCAP and specific guidelines from the annual sessions of its Governing Board. The Centre has a Technical Advisory Committee to provide guidance on technical matters relating to its programme. The objectives of the Centre are to assist the members and associate members of ESCAP through strengthening their capabilities to develop, transfer, adapt and apply technology, improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region. In pursuance of the above objectives, the Centre has been engaged in facilitating the exchange of technology information in the region.

2. The Centre's activities in the technology information field have received support from several United Nations bodies, technology transfer agents and technology generating agencies and organizations in different parts of the world. The Centre since 1987 has been giving importance to such exchange of technological information through its Asia Pacific Tech Monitor, a bi-monthly journal of the Centre. Over a period of time, a very large number of Tech Offers and Tech Requests have been featured in this publication. In more recent years, the Centre has established strong linkages with many other technology information centres in the world and as such, has a regular supply of information from these sources. The Centre has also benefitted through its participation in or organizing of technology expositions from time to time. With the wealth of information which it had acquired, the Centre in 1989 prepared a publication entitled "100 Selected Technologies" in which the broad parameters relating to a technology offer to facilitate an assessment was prepared and this publication was very well received. Encouraged by this, in 1992, the Centre prepared a publication entitled "101 Environment Friendly Technologies" featuring therein technologies from Australia, Austria, China, Cuba, Denmark, Finland, Germany, Hong Kong, India, Indonesia, Israel, Italy, Korea (Republic of), Malaysia, the Netherlands, Nigeria, Norway, Pakistan, Philippines, Russia, Singapore, Sri Lanka, Sweden, Switzerland, Thailand, the United Kingdom, U.S.A. and Vietnam.

3. The broad parameters on which the information relating to a technology offer is presented include brief description, advantages, areas of application, stage of development, production capacity, inputs required, project cost and terms of transfer and other closely related information. Considering the importance attached by the Centre and in United Nations organizations to support activities in the field of sustainable development and the critical role of technology therein, the Centre

recognised the need for considerably enhancing the technical value of such a publication. The Centre had consultations with the Ministry of Environment and Forests of the Government of India on this and sought their suggestions as well as their financial support to bring out a revised, updated and more technically informative publication relating to Environment Friendly Technologies. The result of this initiative is this publication. The Centre is very thankful to the Ministry of Environment and Forests, Government of India for their suggestions as well as for the financial support for bringing out this publication.

4. In the process of reviewing the contents and the technical matter contained therein, the Centre had to reach out far and wide in upgrading the technical contents in some of the technology offers. To start with the Centre had more than 101 technology offers which were environment friendly. This, therefore, necessitated dropping many and retaining the required number and some subjectivity cannot be ruled out. The Centre also recognised the limitations that had been imposed due to the non availability of adequate explanatory, schematic or flow diagrams. Certain innovative measures had to be made in attempting to get a technical appreciation of many of the technologies that had been featured. It is, therefore, likely that in a few cases, the processes described are somewhat brief and the explanatory diagrams provided may not perhaps be the most appropriate in a particular offer. Nevertheless, the process involved in such a technology has been highlighted to a much greater extent than what was possible in the previous publication. The Centre wishes to acknowledge the cooperation rendered by Dr L.M. Pande, Director, Ministry of Science and Technology of the Government of India for his painstaking work in bringing the technical information contained in many of the technology offers to a satisfactory level. The Centre would look forward to comments and suggestions on all the technologies covered here to make them more appropriate for easy application in the developing countries of the region; and such suggestions would be given due consideration in updating this publication in the next edition.

5. The previous version of this publication had categorised the technologies on a countrywise basis and it had been felt that for a more effective utilization, it would be better to arrange the technologies based on a subjectwise classification. An attempt has been made in this publication to group the technologies into broadly three major categories. In the first category are those environment friendly technologies using biotechnology methods, improved chemical processes, other recent improvements and solar energy. In the second category are those technologies for specific gains such as for energy conservation, producing energy from wastes, material conservation, producing building material from waste and for manufacture of new clean products and equipment. The third are those technologies in specific sectors such as food processing, pollution abatement, waste recycling and waste water treatment. The Centre is aware that this classification is somewhat artificial and it could have equally been arranged under some other grouping in view of the fact that in many cases an environment friendly technology has application in more than one specific area. Suggestions on such classification would also, therefore, be very welcome.

6. In the preparation of this publication, the staff of the Centre both present and past have contributed in very many forms and thanks are due to them; in particular, special mention should be made of the painstaking work done by Mr L. Suresh, Mr Basab R. Shee, Mr N. Surya Prakash, Ms Hemalatha Yasas and Ms Uma Rao in compiling this volume.

7. As the technologies contained in this publication have been obtained from various Tech Offers received by the Centre through its Technology Information and Exchange sections, it may be noted that the information contained in each offer, the designations employed and the presentation of the material do not imply any endorsement on the part of APCTT. The price and cost details provided for each technology are only indicative and will have to be ascertained from the owner. It may also be noted that this document is published without formal editing.

8. Considering the importance attached to sustainable development, the Centre is looking forward to a much larger involvement in playing its role in the area of technology transfer, particularly those technologies which are environment friendly. It is hoped that this publication is a positive step in spreading that message.

New Delhi
September 1993

K.V. Swaminathan
Acting Director

## ACKNOWLEDGEMENT

The Ministry of Environment and Forests, Government of India has provided generous financial support to bring out this publication. The Asian and Pacific Centre for Transfer of Technology (APCTT) gratefuliy acknowledges and wishes to place on record this support.

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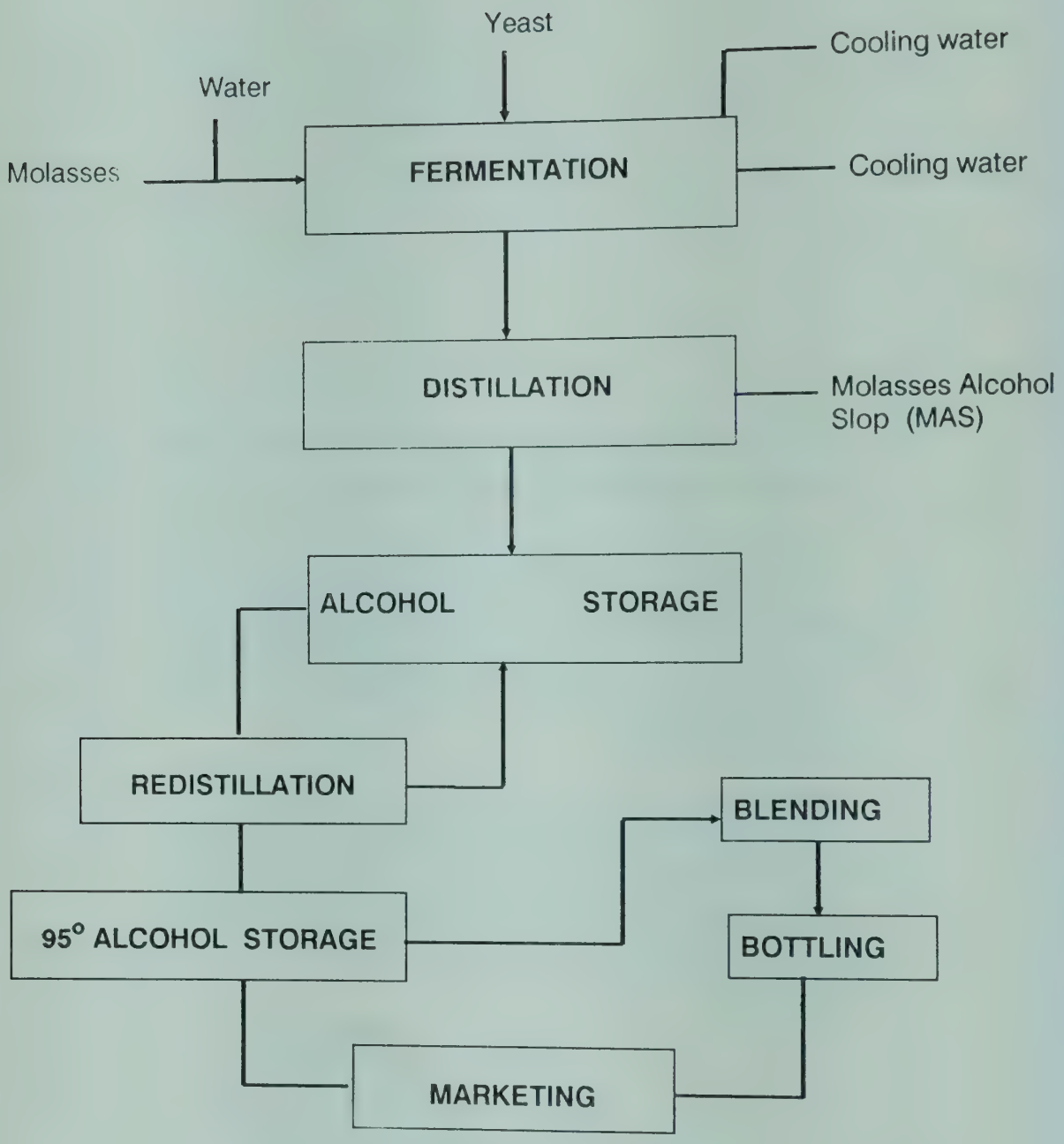
As you turn this page, you will see the first of the 101 technologies contained in this book.

The right-side page contains a brief write-up on a particular technology and the left-side page carries an illustration - a photograph or a diagram pertaining to the technology.

Those who wish to disseminate information about their technology offers through APCTT publications should send information in a two page format as in this publication.




LIQUOR AND ALCOHOL DISTILLATION FLOW DIAGRAM

# CONTINUOUS FERMENTATION PROCESS TO PRODUCE ETHANOL - FERCEN

## Description

This process consists of a single-stage fermentation process that takes place in an agitated fermenter in which the fermentation medium is perfectly homogeneous. The wort is continuously fed to a pre-fermenter where it is mixed with yeast and where air is sparged. The mixture is then pumped to a series of agitated fermenters that operate in parallel and with constant volume, establishing a controlled residence - time adequate to convert into ethanol most of the sugar contained in the medium. As the wort is fed to the fermenters, the fermented broth is pumped to the centrifuge separators, where it is divided in two fractions: yeast-concentrate and yeast-free fermented broth. The yeast-concentrate stream is recycled to the pre-fermenter and may or may not have its pH corrected. Part of this stream can be purged to produce biomass with high protein content. The yeast-free fermented broth is transferred to an attenuation fermenter that operates under conditions in which all its residual sugars are also converted into ethanol, without losses due to unconverted sugar. Finally, the fermented broth free from residual sugars is sent for distillation.

## Advantages

Lower space and equipment requirements and lower capital costs
Use of different types of wort like sugar cane juice, treated molasses or corn-syrup
Possibility of using conventional yeasts as well as selected strains
High fermentation yield and efficiency (up to 92% Gay-Lussac efficiency)
Possibility of using simple automation devices
Higher productivity (up to 10g ethanol/litre fermenter/h)
Possibility of production of cattle fee-d from the excess of yeast purged from the system

## Areas of Application

Fermentation of sugar-cane juice, molasses, or syrup, to produce ethanol.

## Stage of Development

Commercialised since 1988 in Brazil. Patents granted in Britain, USA, Argentina, Brazil, Cuba and India

## Inputs Required

*Raw materials* : Sugar cane juice, molasses, syrup, or a mixture of these; corn syrup
*Utilities* : Power - 40 kWh/1000 L. ethanol; Low pressure vapour - 1,275 Kg/1000 L.ethanol; 90,000 L./1000 L.ethanol (closed circuit); 10,000 L./1000 L.ethanol (open circuit)
*Required area* : Indoor - 200 $m^2$; Outdoor - 600 $m^2$

## Project Cost

*Equipment/Machinery (FOB)* : US$400,000
*Operational costs for one year* : Depends on the cost of raw materials
*Technology/Engineering Services* : US$200,000

## Terms of Transfer

Licensing, Joint venture, Turnkey

*Contact* : JOSE OSWALDO DA SILVA, DIRECTOR, ENGENHO NOVO TECNOLOGICA AGROINDUSTRIAL LTDS, RUA TEOFILO OTONI, 63/20 ANDAR, 20090-080 - RIO DE JANEIRO - RJ, BRAZIL ☐ TELEPHONE : 55-21-2339382 ☐ FAX : 55-21-2533286 ☐ TELEX : 23481

INSTRUMENTED AND COMPUTER CONTROLLED
DISTILLATION PLANT OF 12,000 LIT/DAY CAPACITY

FERMENTERS AT MCDOWELL & CO. LTD, SHERTALLAY

# ENERGY EFFICIENT PROCESS FOR HIGH ALCOHOL CONTENT

## Description

Molasses is a by-product of the sugar industry. In India, as in other countries of Asia, Africa & Latin America, molasses is used to produce alcohol by a process of fermentation using yeast. Conventionally at the end of fermentation the broth has around 6.5 to 7.5% alcohol.

The process being offered comprises of a Osmotolerant High Alcohol Yeast along with associated fermentation and distillation technology such that it can produce a broth with 10.5 to 12% alcohol with high efficiency and good productivity. When this broth is distilled there is a saving of 15 to 20% in the requirement of steam for distillation. This offers considerable economy to the process of manufacture of alcohol.

## Advantages

No change in net pollution load
Reduction in effluent volume by 30%
15-20% savings in steam distilled.
Pay back period about 1 1/2 years for additional investment made.

## Areas of Application

This process can be applied to any manufacture of alcohol by the fermentation process.
The alcohol may be for industrial use or for potable purposes
The manufacture may be based on cane molasses, beet molasses, or sugars from conversion to starch or cellulosic residues.

## Stage of Development

Commercialised

## Inputs Required

*Raw materials* : Molasses or other sugar source
*Utilities* : Power - 180,000 KwH/year; Water - No increase

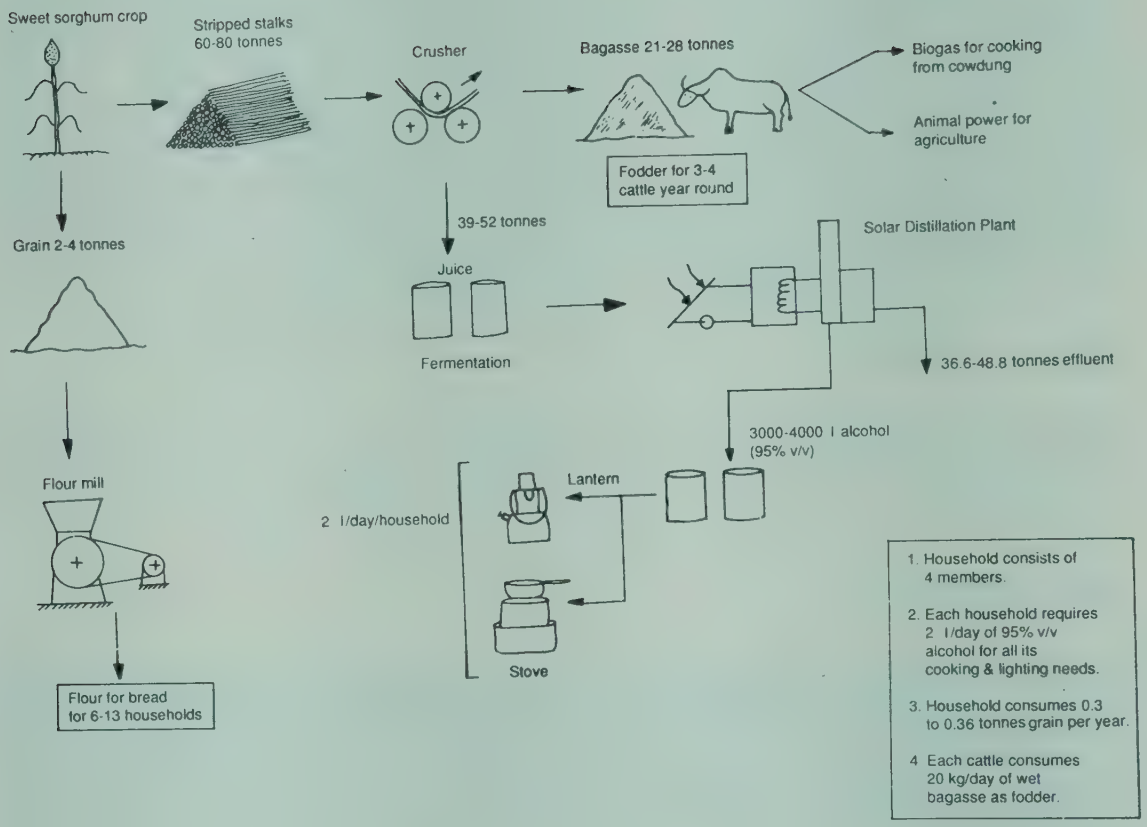
## Project Cost

For existing 20,000 lit/day alcohol plant:
*Equipment/Machinery (FOB)* : US$50,000
*Operational cost for one year* : (-)$83,676

## Terms of Transfer

Licensing

*Contact* : DR A K BHANDARI, VITTAL MALLYA SCIENTIFIC RESEARCH FOUNDATION, POST BOX NO.406, K.R.ROAD, BANGALORE 560 014, INDIA ☐ TELEPHONE : 080-628643 & 628644 ☐ FAX : 0812-623951




## HOW IT ALL HAPPENS !

# ETHANOL FROM SWEET SORGHUM

## Description

Traditionally, alcohol has been produced mainly from sugarcane and molasses. Sweet sorghum, being a multipurpose crop and tolerant to a wide range of climatic and soil conditions, fermentation studies were conducted on the juice of sweet sorghum varieties developed by the technology offerer, using strains of Saccharomyces cerevisiae. A total of 16 strains were screened and NCIM 3319 was found to be best suited for fermentation. The average fermentation efficiency obtained was 90% and the fermentation was completed between 48-72 hours. The juice is claimed to contain an average of 10-11% (w/w) total fermentable sugars and the alcohol yields are about 6% (v/v). Thus these varieties of sweet sorghum can produce about 1000-2000 litre/hectare/season of 95% (v/v) alcohol.

A pilot solar distillation plant consisting of 38 $m^2$ of flat plate solar collectors coupled to a hot water storage tank of 2150 litre capacity has been set up. The distillation column is of packed bed type and has been specifically designed to run at distillation temperatures of 50-70$_o$C. However, the plant has also been modified to run on a biomass powered producer gas unit which uses dried sweet sorghum bagasse.

## Advantages

Renewable replacement for fossil fuel

Raw materials are available locally

It can be used for cooking and lighting fuel

## Stage of Development

Pilot plant

## Terms of Transfer

Licensing

Production capacity: 5000 litres/day

## Project cost: Plant price US$250,000/-

fees for technical know-how/training US$15000/-

## Inputs

Raw material - Sweet sorghum 150 tons/day

Equipment M/C (FOB) - US$200,000/-

Operational maintenance cost/year: 20% of the capital cost

*Contact*:: DR. ANIL K. RAJVANSHI, PO BOX 44, PHOLTAN - 415523, MAHARASHTRA STATE, INDIA

VIEW OF A DISTILLERY

## PRODUCTION TECHNIQUES FOR DIFFERENT KINDS OF ALCOHOL

### Description

Plants and machinery based on the latest technique of continuous/semi-continuous fermentation and distillation for the manufacture of various grades of alcohol (potable, industrial, perfumery and power) from a variety of sugar/starch based raw materials including cane molasses, beat molasses, cane juice, maize, barley, tapioca, wheat, rice, potatoes, etc. Also offered are modernization packages for upgrading the operations of the existing distilleries.

### Advantages

Production of superior quality alcohol
High fermentation efficiencies in the range of 88-90% giving higher yields per ton of raw materials
Energy efficient designs of distillation plants reduce steam consumption by over 20%
Low cost of production
Appropriate technologies for developing economics
Existing distilleries can be modernized within most of the available infrastructure
Effluent generation will be in the range of 10-11 litres per litre of alcohol and must be treated.
Standard system based on incineration or biomethanation are available
For starch based plants, the effluent is converted into cattle feed.
Options which give high quality alcohol consistently and efficiently, achieving economies in both raw materials and energy.

### Areas of Application

As alcohol beverages, perfumery, fuel and as a raw material for a variety of chemicals including acetic acid, ethylene, PVC, PVA, Styrene, LDPE, HDPE, pesticides, etc.

### Stage of Development

Commercialised in India since 1986

### Inputs Required

Raw material, power, water and other chemicals - depends on the capacity of the plant and final product required.

### Terms of Transfer

Turnkey

### Project Cost

Depends upon plan capacity, raw material and final product required.

*Contact* : MR ANIL DESHPANDE, DIRECTOR-MARKETING, PRAJ INDUSTRIES LIMITED, 917/17 BRITISH LIBRARY LANE, OFF F.C. ROAD, PUNE 411 004, INDIA ☐ TELEPHONE : +91-212-349400, 349604/5/6 ☐ TELEX : 145-7725 PRAJ IN ☐ FAX: +91-212-349558

A TYPICAL PLANT

# TREATMENT OF BIOGENOUS AND ABIOGENOUS WASTES

## Description

The process is an alternative to the commonly used methods of disposal and incineration. The concept implies the conversion of organic household refuse/residue mixtures into a stable compost and aims at hygiene improvement, stench reduction and permanent humus formation. The end product can be recycled as fertilizer. It is also possible to treat refuse and residues containing heavy metals or other hazardous materials physically, chemically and biologically.

## Advantages

Waste utilization technology

The end product is stable

Can be stored for prolonged periods

Environmentally safe.

## Areas of Application

Waste treatment, chemicals and fertilisers

## Stage of Development

Patented. Prototype available

## Terms of Transfer

Subcontracting, know-how.

*Contact* : PETER KUSCHEL, ERFINDERZENTRUM NORDDEUTSCHLAND GMBH, GERMANY ☐
TELEPHONE : 49-511-813051 ☐ TELEX : 511 8452 EZN ☐ FAX : 49 511 2834075

A VIEW OF AN ETHYLBENZENE PLANT

## "ALBENE" TECHNOLOGY FOR CONVERTING ETHYL ALCOHOL AND BENZENE INTO ETHYLBENZENE

### Description

"ALBENE" is a single step reaction process for conversion of Ethyl Alcohol and Benzene into Ethylbenzene. The reaction is carried out in the vapour phase over a zeolite based catalyst in a series of alkylation reactors. The higher ethylbenzenes formed in the alkylation step are trans-alkylated to ethylbenzene in another reactor stream. The reaction products are then condensed and purified in a series of distillation columns for the removal of unreacted benzene, higher ethylbenzenes and other impurities. The ethylbenzene thus formed is used in the manufacture of styrene monomer.

### Advantages

- Total conversion of alcohol
- Lower energy consumption than conventional process
- No toxic or corrosive chemicals used
- Final product is totally devoid of chlorides and flourides
- Does not require anti-corrosive coatings
- Ecologically safe and simple process.

### Areas of Application

Chemical industry. Ethylbenzene, is an intermediate product in the production of styrene/polystyrene from alcohol and benzene.

### Stage of Development

Commercialised in India since 1989

### Production Capacity

13,000 tons per annum

### Inputs Required

*Raw materials* : alcohol - 15,500 Kl of rectified spirit per annum; benzene - 20,000 MT per annum; *Utilities* : Power - 4 x $10^6$ KWH; Power load for a battery limit plant is about 500 KW, Water - 108 I.Gal., Catalyst - 5,000 kg.; *Required Area* : Land : 3,000 sq.m.; Manpower : Skilled - 50, Technicians - 60, Unskilled - 85

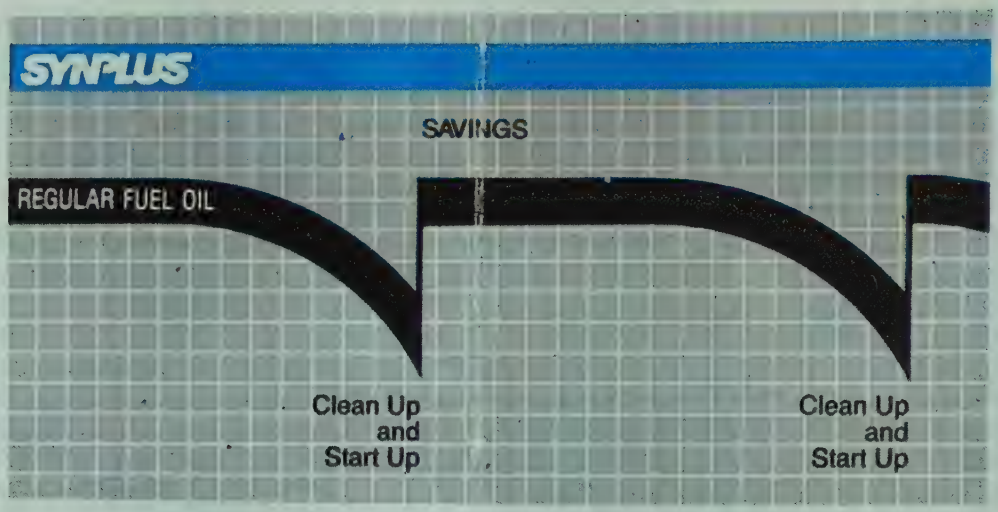
### Project Cost

*Equipment/machinery* : US$ 5 million

### Terms of Transfer

Licensing

*Contact* : S.K. BHOWMIK, CHIEF EXECUTIVE - HINDUSTAN POLYMERS, RR VENKATAPURAM POST, VISAKHAPATNAM 530 029, INDIA☐ TELEPHONE : (089) 58455 ☐ TELEX :0495-586 AND 236; FAX : (0891) 58538




EFFICIENCY COMPARISON

LOWER MAINTENANCE AND POLLUTION
(LESS EMISSION OF SMOKE AND ASH)

## EMULSIFICATION OF FUEL OIL

### Description

The process is water-in-oil emulsification of fuel oil for oil conservation and pollution control with the help of Blending Machine and Chemical Catalyst. Emulsification leads to finely distributed water particles in the oil phase. On combustion, water particles vaporize causing micro explosions of fuel oil droplets which lead to finer secondary atomisation and this leads to more complete combustion. Technical specifications are: Water injected @5 to 10% of fuel oil; Catalyst @ 1% of water injected.

### Advantages

Reduction in fuel oil consumption to the extent of 3-7%
Helps to reduce air pollution
Reduction in soot formation this maintaining longer boiler efficiency
Reduction in tube fouling helps keep maintenance costs low
Initial cost involved is in buying blending machine
Recurring cost is of catalyst used

### Areas of Application

Can be used where there is a captive consumption of heavy fuel oil for use in boilers/furnaces.Can be used as a terminal for emulsifying heavy fuel oil to be sold/distributed to other users of fuel oil for oil saving.

### Stage of Development

Commercialised in India since 1987

### Inputs Required

*Raw materials* : Chemical catalyst - 200 KL/year; D.M.Water and fuel oil
*Utilities* : Power - 106,000 kWh/annum; Water - 20,000 $m^3$/annum; Tracing system
*Required area* : Indoor - 500 $m^2$; Outdoor - 1500 $m^2$

### Project Cost

*Equipment/Machinery (FOB)* : US$50,000
*Operational cost for one year including cost of catalyst* : US$260,000

### Terms of Transfer

Licensing

---

*Contact* : MR. VINEET JAIN, EXECUTIVE DIRECTOR, SYNERGY EMULSIFUELS PRIVATE LIMITED, "SYNERGY HOUSE", SUBHANPURA, BARODA 390 009, INDIA ☐ TELEPHONE : 265-333912

CITRONELLA FARM

# ESSENTIAL OIL STEAM DISTILLATION UNIT

## Description

A suitable steam distillation unit for distilling leaf essential oils e.g. Cinnamon leaf, Citronella, Lemongrass etc. Capacity 400 kg. leaf material loading at a time.

## Advantages

A single unit with its own steam generating capacity. Static water condenser unit suitable for use in water scarce area. Shorter operating time duration e.g. 4-5 hrs per single batch distillation. Use of aluminium tubular condenser for economical reason. Mild steel body mounted on brick construction.

## Areas of Application

Field distillation of leaf material for the recovery of essential oils.

## Stage of Development

Semi-commercialized in Sri Lanka since 1982

## Production Capacity

Unit market price : US$ 6200

## Inputs

Raw materials : Distilling leafy material, firewood (500 kg/day); Utilities : Well with water pump; Building : 100 sq mts; Manpower : Skilled - 2; Un skilled - 2

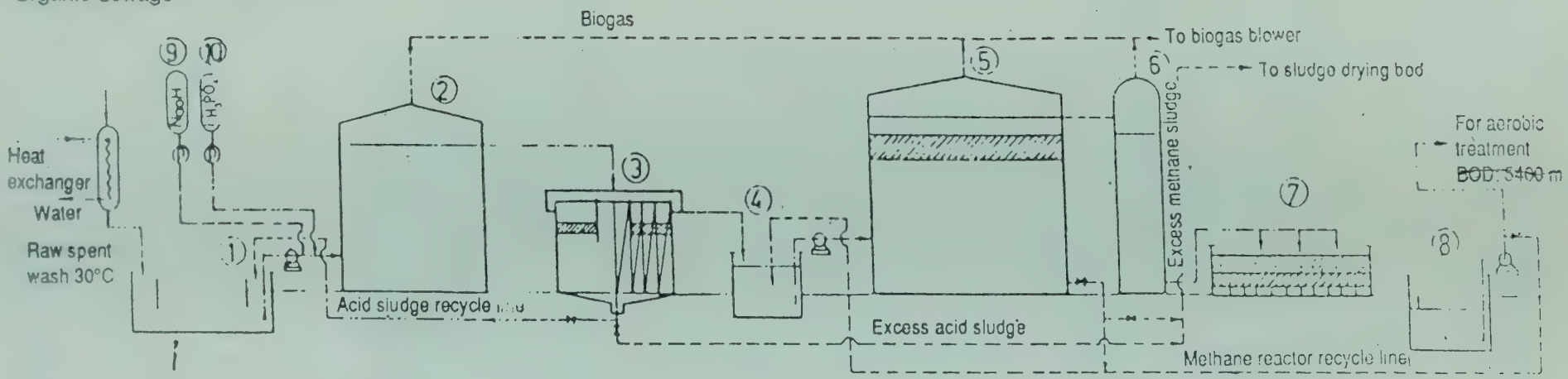
## Project Cost

Blue prints : US$ 1500; Training : US$ 4000

## Terms of Transfer

Turnkey

*Contact* : DIRECTOR, CISIR, P.O. BOX 787, COLOMBO, SRI LANKA




| Unit No | Name |
|---|---|
| 1 | Equalisation cum pH collection tank |
| 2 | Acid reactor |
| 3 | Acid sludge settler |
| 4 | Interim collection tank |
| 5 | Methane reactor |
| 6 | Biogas desorber |
| 7 | Semi rapid sand filter |
| 8 | Filtrate collection tank |
| 9 | Naoh storage tank |
| 10 | $H_3PO_4$ storage tank |

PROCESS FLOW DIAGRAM IN ANAEROBIC DIGESTION PLANT

## HIGH EFFICIENCY ANAEROBIC SLUDGE BED REACTOR

### Description

This is a biological treatment technology for treating high concentration organic sewage. It has special effects on utilizing biological energy and controlling organic contaminant. The anaerobic treatment is also a measure for developing new energy resources by the technology of transferring sludge gas from organism.

### Advantages

The common energy can be replenished by the technology of transferring harmful substances from sewage into sludge gas.
The products (gas, water, drugs) left by treatment has multiple uses and has high economic benefits.

### Areas of Application

In sewages of spirits, brewery, citric acid, yeast, M.S.G. antibiotics etc. and in sewages of fermenting starch, fermenting bean products, dairy, sugar making, and in chemical and life sewages.

### Stage of Development

Appraised by N.S.T.C. and put into production.

### Inputs Required

*Raw materials* : Steel
*Utilities* : Power - 360,000 kWh/annum
*Required area* : Indoor - 1000 $m^2$; Outdoor - 3000 $m^2$

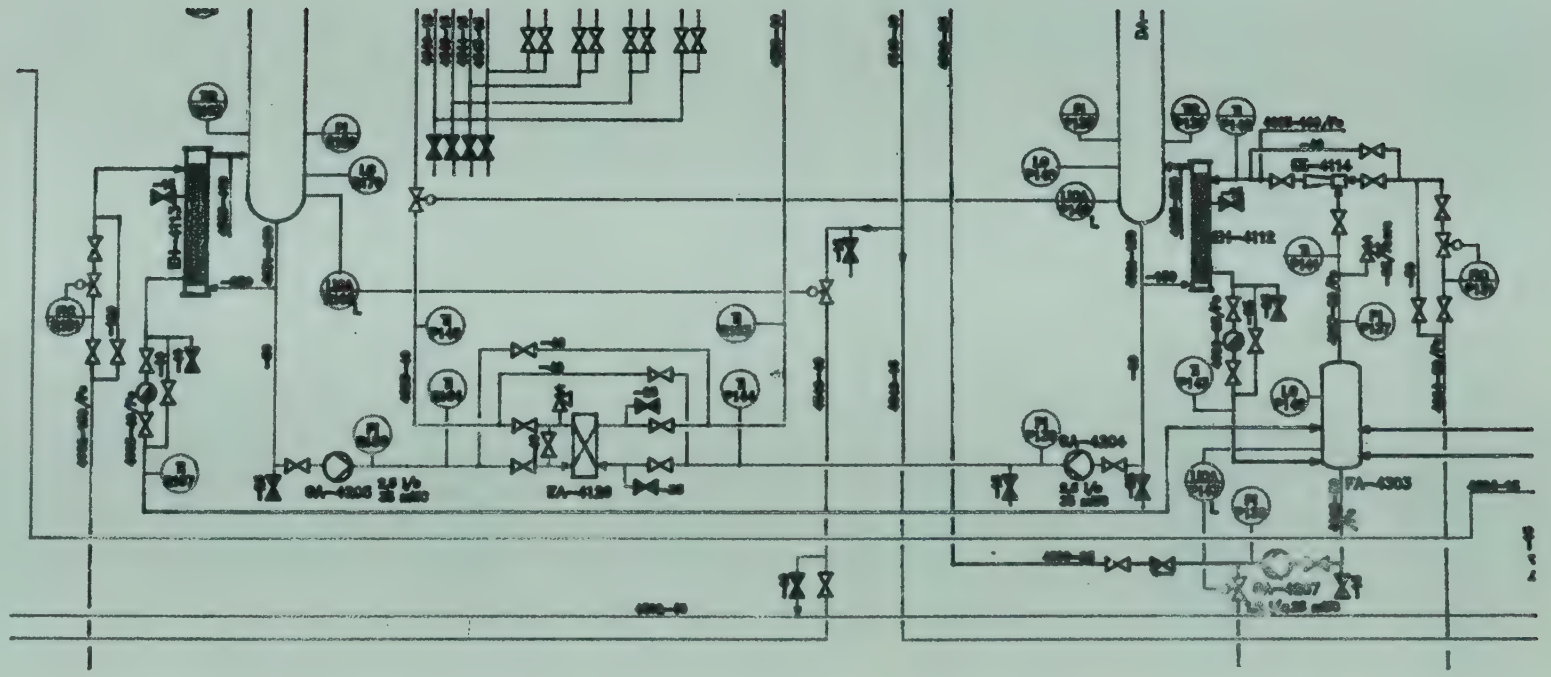
### Project Cost

*Excluding land and building* : US$600,000
*Equipment/Machinery (FOB)* : Yuan 700,000
*Operational cost for one year* : Yuan 144,000

### Terms of Transfer

Licensing, Joint venture

*Contact* : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245



AN OUTLINE OF PROCESSING STEPS

## INTEGRATED PRODUCTION OF STARCH; ETHANOL PROTEIN RICH FODDER AND EDIBLE FIBRE

### Description

The production process of starch and ethanol use starch containing raw materials, which after pretreatment grinding etc. be fermented and distilled to pure ethanol. The remaining components of raw materials used as a dried stillage for fodder.

### Advantages

Low investment

Optimisation of raw material and energy recovery

### Stage of Development

Commercialised in Finland

*Raw materials* : Molasses; Cane juice; Corn; barley; wheat; rice; sorghum; cassava; Potatoes; or almost any carbohydrate-rich material

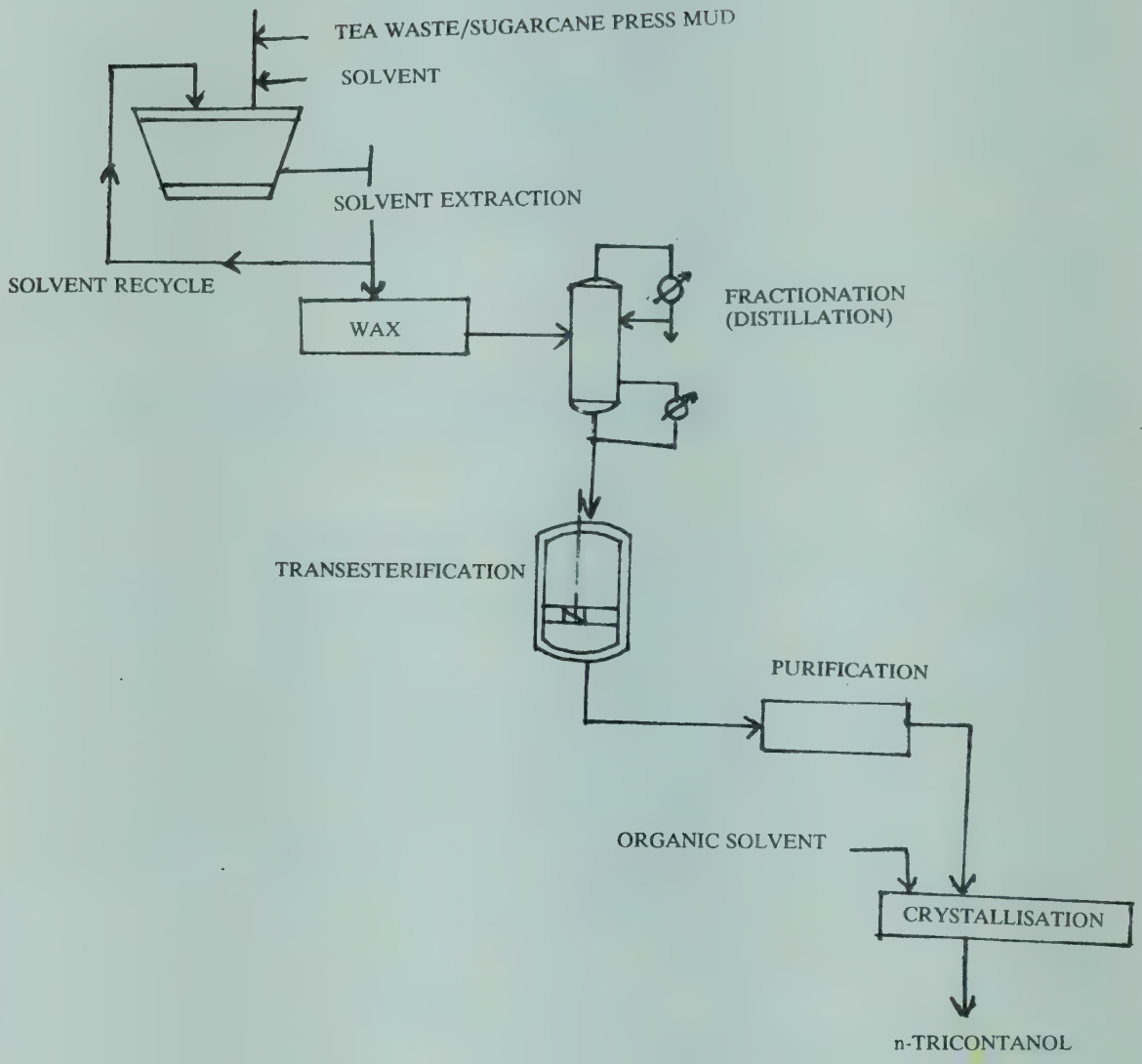
### Process Steps :

- Start : Storing; pretreatment; milling; mixing
- Preparing the mash : gelatinization; sterilization; liquefaction; saccharification; adjusting
- Fermentation : slow batch; rapid batch; semicontinuous; continuous; yeat propagation; yeast recycling; yeast recovery; $CO_2$ recovery
- Distillation : separation; purification; distillation; rectification; dehydration
- Spent wash utilization : separation; evaporation and drying; combustion; recycling energy and water
- Final Products : Alcohol, Fodder, Carbondioxide

### Terms of Transfer

Licensing; Sub-contracting; Turnkey

Contact : MR. KYOSTI VENTO, DIRECTOR, PROCESS ENGINEERING DIVISION, ALKO LTD., SF-05200, ROJANAKI, FINLAND




FLOW DIAGRAM

## PLANT GROWTH PROMOTER CONTAINING N-TRIACONTANOL

### Description

This is a process for isolating pure form of n-Triacontanol, a plant growth promotor, from active fraction of tea waste and from sugarcane press mud. Tea wax/sugarcane wax is extracted from tea waste/sugarcane press mud by solvent extraction process. The wax is then fractionated and purified. After transesterification under appropriate conditions, the compound is further purified and fractionally crystallised using suitable organic solvents.

### Advantages

There is no effluent generation.
Chemicals are recycled.
When administered with Triacontanol, plants absorb more carbon dioxide from the air. Waste utilization.
Cost effective product.

### Areas of Application

Agriculture, plant nutrition.

### Stage of Development

Commercialised in India.

### Inputs Required

*Raw materials* : Tea wastes, sugarcane press mud, benzene, ethylene dichloride, methanol, acetone
*Utilities* : Power - 22.5 KW, Water - 600 Kl per annum
*Required Area* : Building - 186 sq.m., Land - 560 sq.m.
*Manpower* : Skilled -2: Unskilled-2
*Production Capacity : 6 kg/annum*

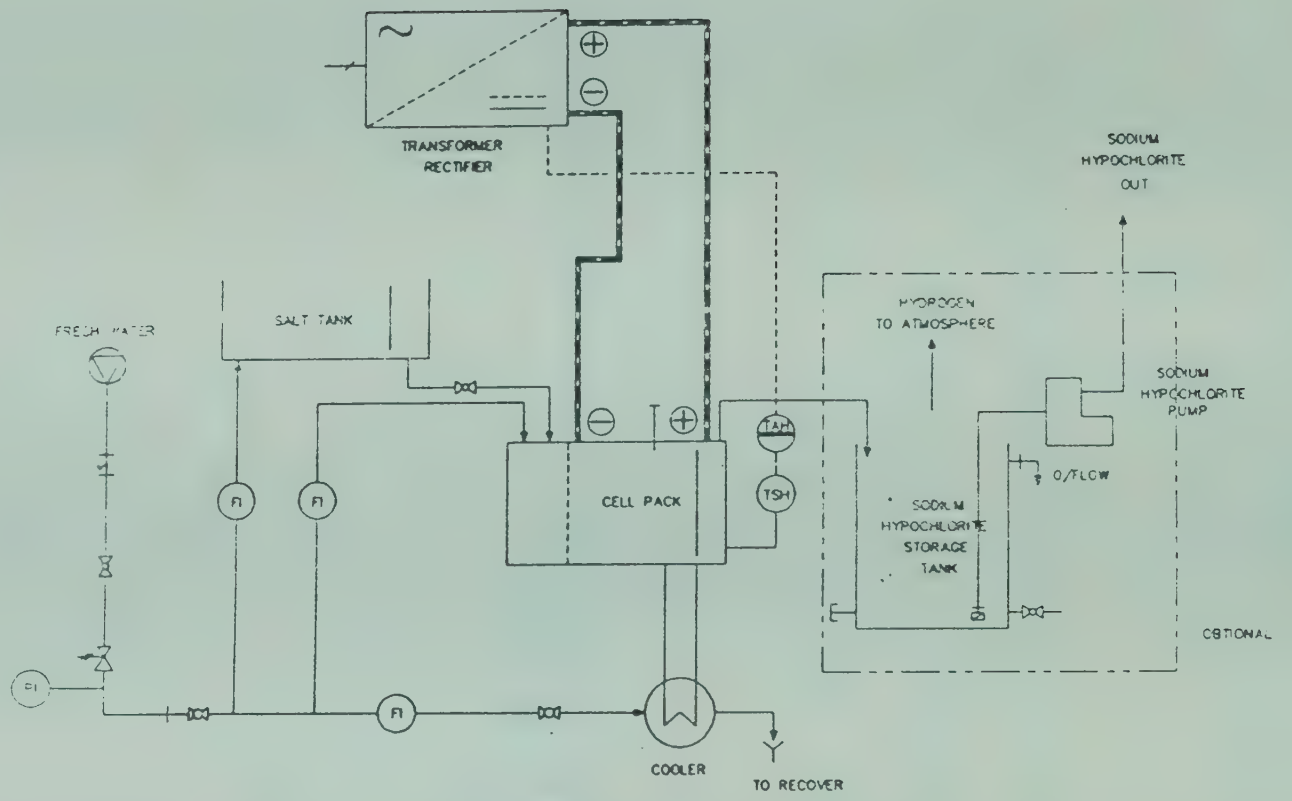
### Project Cost

*Equipment/machinery* : US$ 7,500
*Operational cost* : US$ 44,450/year

### Terms of Transfer

Licensing

*Contact* : CHAIRMAN, TECHNOLOGY APPLICATION DIVISION, CENTRAL FOOD TECHNOLOGY RESEARCH INSTITUTE, MYSORE 570 013, INDIA ☐ TELEPHONE : 32770, 36300 ☐ TELEX : 0846-241 FTRI-IN ☐ FAX : 0821-27697




LEGENDS

LINES — PROCESS LINE — ELECTRIC LINE — D.C. CABLE

INSTRUMENTS — LOCALLY MOUNTED — PI PRESS INDICATOR — FI FLOW INDICATOR C/W NEEDLE VALVE — TAH TEMP. ALARM HIGH (LOCATED AT RECTIFIER PANEL) — TSH TEMP. SWITCH HIGH

OTHERS — PRESSURE REDUCING VALVE — BALL VALVE — Y-STRAINER — FOOT VALVE

PROCESS FLOW DIAGRAM

# PRODUCTION OF HYPOCHLORITE SOLUTION

## Description

This process consists of pre-engineered units and custom engineered plants based on the electrolytic generation of sodium hypochlorite in solution from salty waters, using direct current electricity. The processing facility consists mainly of -AC/DC rectifier, electrolytic cells (generator), salty water feeding and hypochlorine handling equipment. The most common ready-made solution is seawater. When that source of inexpensive salt is not available or not suitable for the desired quality of the product, artificial brine is prepared using solid salt and tap water. The process eliminates dependency upon expensive and hazardous liquid chlorine (gas chlorinator) and other chlorine-based chemicals (solid calcium hypochlorine - commercial sodium hypochlorine solution), with high residual alkalinity and significant storage - decomposition rates.

## Advantages

Ecologically clean product.

Replaces hazardous liquid chlorine and other chlorine-based chemicals.

## Areas of Application

Environmental engineering including disinfection, sterilization, sanitation, etc. Protection from biofouling of seawater cooling circuits of coastal power and industrial plants, large airconditioning units, offshore platforms, ship engines, removal of metal impurities, BOD reduction, odour control in gas treatment plants.

## Stage of Development

Commercialized in Singapore and Italy.

## Production Capacity

An aggregate daily production capacity in the range of 30 MTPD chlorine equivalent.

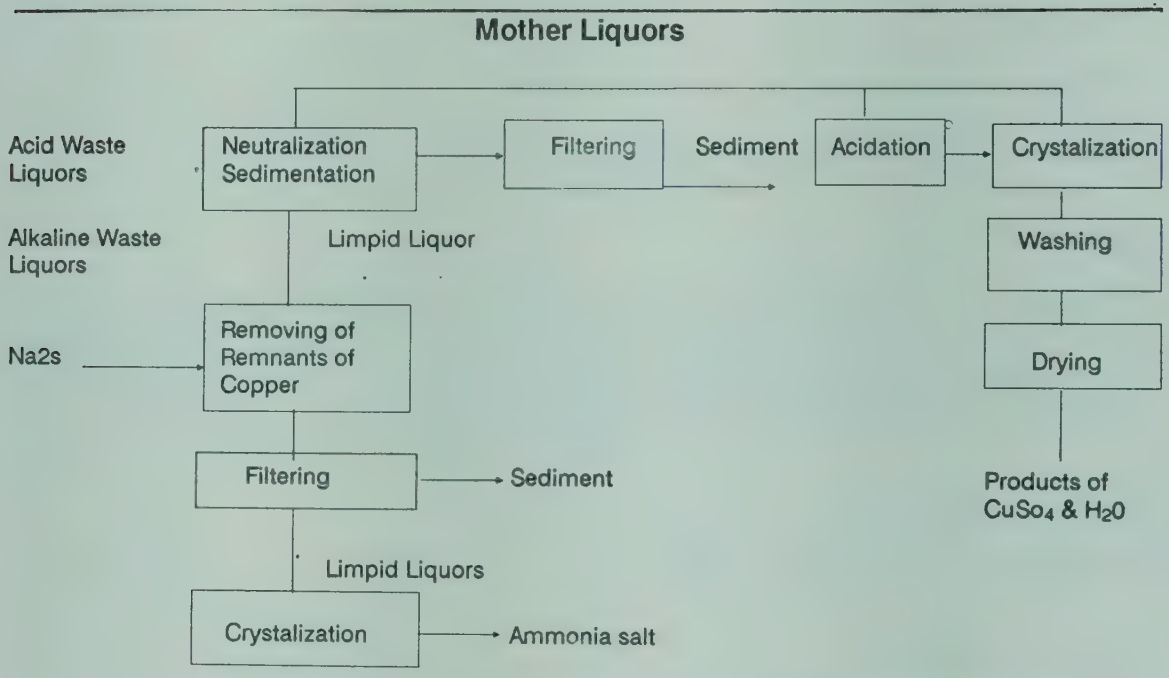
## Inputs Required

*Raw materials* : Salt (sodium chloride) or seawater.
*Utilities* : Power - 3.5 to 5.5 KWH/annum (for 1 kg chlorine produced); Water - tap water approximately 140 lt (for one kg chlorine equivalent produced using salt); Others - approximately 4 kg salt (for 1 kg chlorine equivalent produced).

## Terms of Transfer

Licensing, Subcontracting.

*Contact* : ROBERTO MARTELLI, MANAGER SEACLOR DIVISION, DE NORA PERMELEC PTE LTD., 17 TUAS STREET, SINGAPORE ☐ TELEPHONE : (65) 861 7560☐TELEX : RS 38278 DNPFE☐ FAX : (65) 861 3296




TECHNOLOGY FLOW SHEET

# RECOVERY OF CORROSIVE WASTE LIQUORS FROM MANUFACTURE OF IC BOARDS

## Description

This is a centralized technique for treating and recovering copper and the by-products $NH_4Cl_2$ and CuS from the three corrosive liquors commonly used in the production of electronic integrated circuit (IC) boards - Acid copper chloride ($CuCl_2$), alkaline copper ammonia ($CuCl_2$-$NH_4OH$) and $FeCl_3$ solution.

## Advantages

Waste utilization technology.
No secondary pollution.
96% of Cu can be retrieved.
Simple process.
Cost effective.

## Areas of Application

In small, medium and large IC boards manufacturing units.

## Stage of Development

Commercialised in China

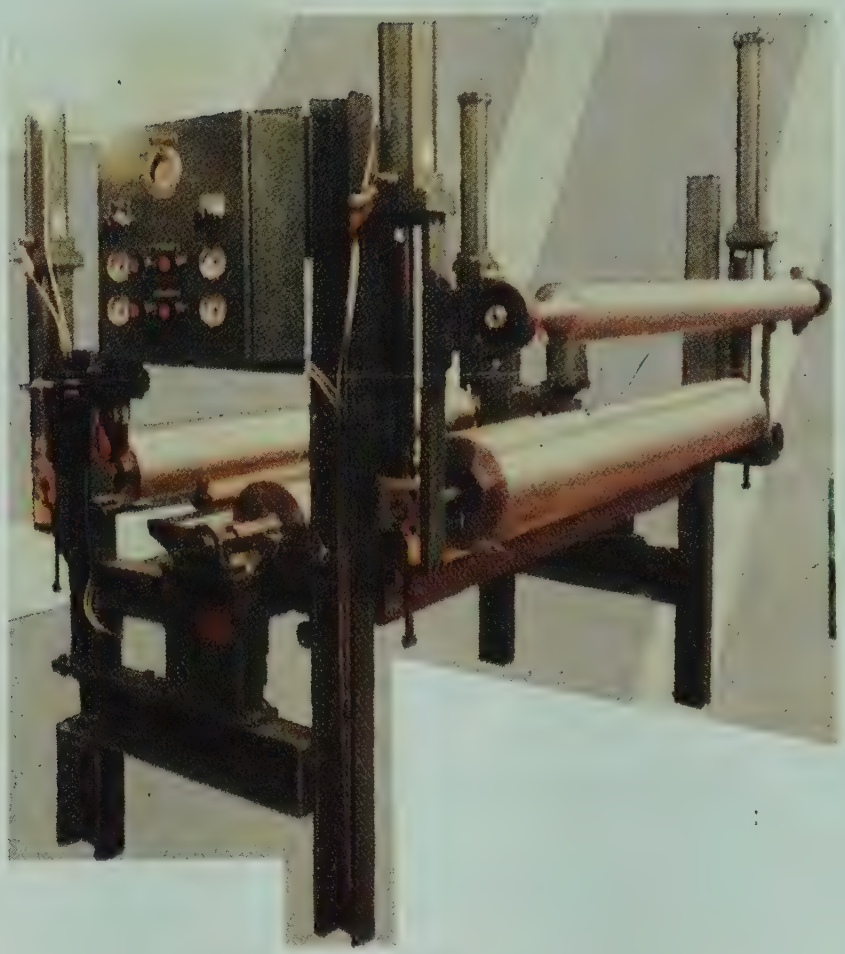
## Inputs Required

*Raw materials* : Waste solutions from printed circuit boards.
*Utilities* : Power or fuel - 50kW/annum; 14600 Kwh/annum, Water - 50 t/day, Others - Truck: 1; Tank trucks : 2.
*Required Area* : Building - 500 sq.m., Land - 500 sq.m,
*Manpower* : Skilled - 13, Unskilled - 7.

## Project Cost

*Equipment/machinery* : US$ 150,000
*Operational cost* : US$ 80,000/year

*Contact* : SHEN ZHEN MUNICIPAL ENVIRONMENTAL PROTECTION BUREAU, NO. 8, SHANG BU ROAD CENTRE, SHEN ZHEN, GUANGDONG 518 027, CHINA (P.R) ☐ TELEPHONE : (0755) 237 609; 902 075 ☐ FAX : (0755) 234 762



A VIEW OF MAYER ROD COATER

# SOLVENT FILM CARBON [SFC] PROCESS

## Description

The process makes use of non-waxy synthetic materials instead of the conventional waxy ink compositions for coating carbon paper. SFC has microscopic 'Honey-Comb' like coating impregnated with high-grade ink. By capillary action, the ink migrates to the area from where it is squeezed out while typing.

## Advantages

SFC is coated with non-greasy synthetic, microscopic ink.
Tough, resilient plastic film base resists rips, tears, curls, punches, etc.
Prints sharp copies, in non-smudging ink, without any smeary carbon marks.
Replenishes the ink itself with each typing.
Can make nearly 15 copies in single typing, with sharp, legible & smear-proof impressions.
Cost-effective.
Environmentally clean technology.

## Areas of Application

Used in the manufacture of one-time carbon papers as well as typewriter and computer ribbons besides typewriter and pencil carbons.

## Stage of Development

Patented in India since 1983. The process was commercialised in USA several years ago.

## Production Capacity

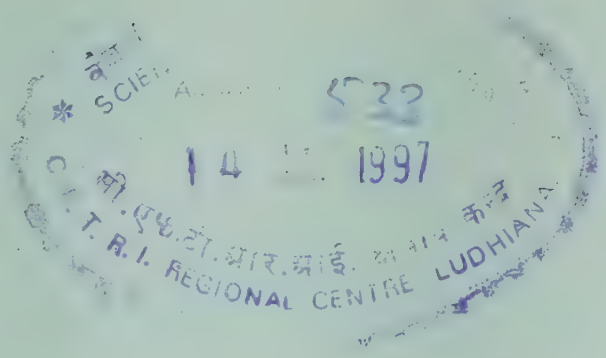
450,000 boxes each containing 100 sheets of size 8 1/2" x 13".

## Inputs Required

*Raw Materials* : Synthetic materials, fatty acid, vegetable/mineral oils, pigments, prepared chalk, chlorinated hydrocarbons, plastic film, packing materials, etc.
*Utilities* : i) Power -70 kW; ii) Water - 8,000 litre/day
*Required Area* :Indoor - a) 60 sq.m [for administration]; b) 200 sq.m. [for production] and c) 200 sq.m. [for storage].
*Others* : Testing - lab equipment.

## Project Cost

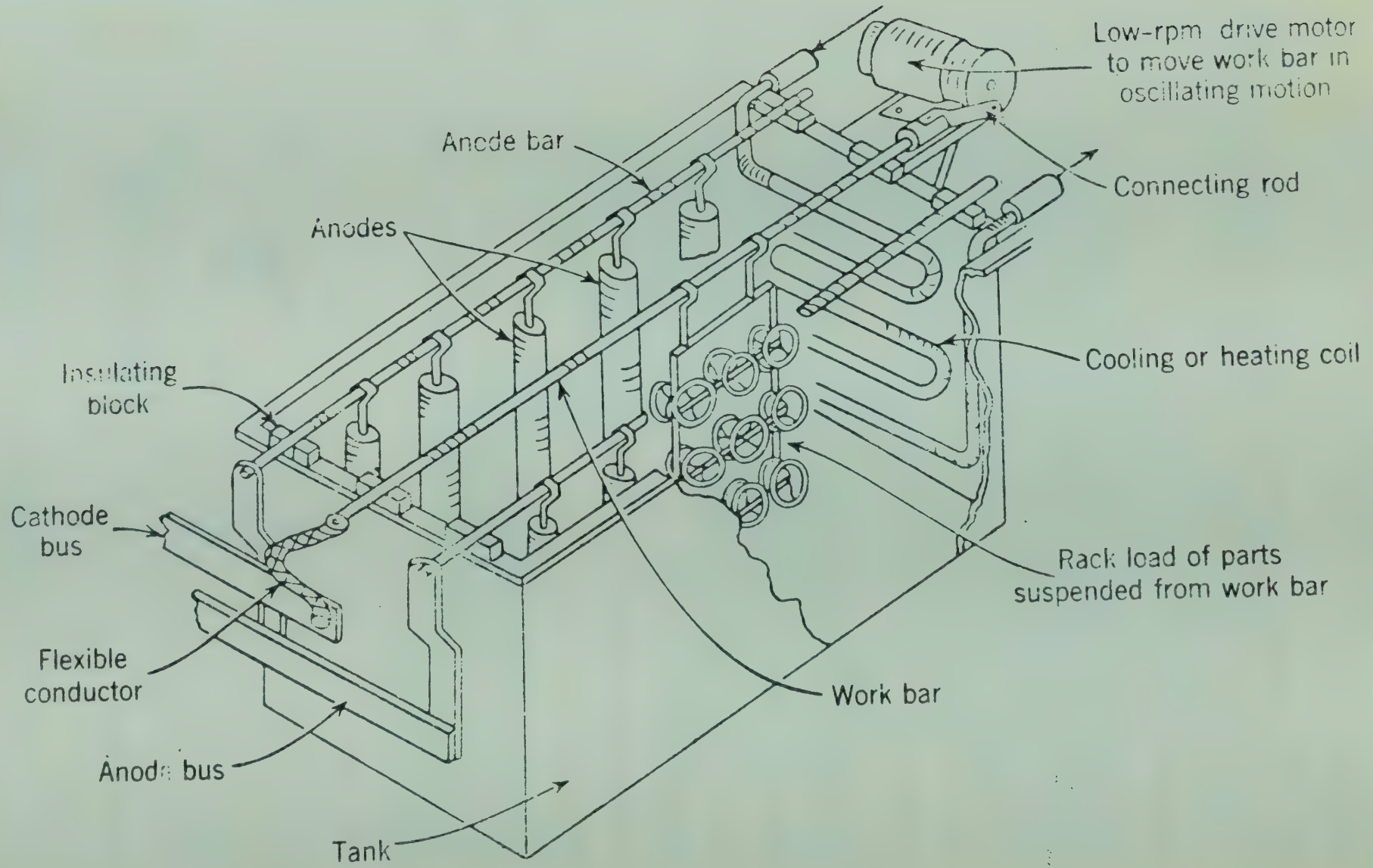
*Equipment/Machinery* :
US$ 300,000.
*Operational cost* :
US$ 500,000/year.
*Fee for technical know-how:*
US$ 20,000 plus 5% of turnover




## Terms of Transfer

Licensing

*Contact* : P. KANDASWAMI, 94/1, PERAMANUR EAST STREET, SALEM 636 007, TAMILNADU, INDIA




A VIEW OF AN ELECTROPLATING TANK

## CORROSION/ABRASION-RESISTANT COATING FOR OIL WELL TUBINGS AND FITTINGS

### Description

In this special electrolysis process, oil well tubings and fittings (ID and/or OD) are coated with nickel. The coating makes the parts resistant to corrosions caused by agents such as $H_2S$, $CO_2$, Chlorides, oil and gas contaminants, brines, mud, etc. The thickness of the coating (48 to 70 FRC) also gives them excellent wear and abrasion-resistance.

### Advantages

Coating lengthens the life of the tubings and fittings by 10-20 times.
Involves only minimum investment for coating 9 mm ID/OD tubing.
Enables continuous working of the well without replacing tubings, thus reducing labour.
Easy disassembling of tubings prevents damages on threads.

### Areas of Application

All parts of inland and offshore oil well fittings exposed to high corrosion such as drill pipes, connectors, ball and gate valves, pumps, pump barrels, casings, etc.

### Stage of Development

Commercialised in Argentina since 1987

### Inputs Required

*Raw materials* : Chemicals (nickel)
*Required Area* : Building - 300 to 500 sq.m., Land - 1,000 sq.m.
*Manpower* : Skilled - 5, Unskilled - 8

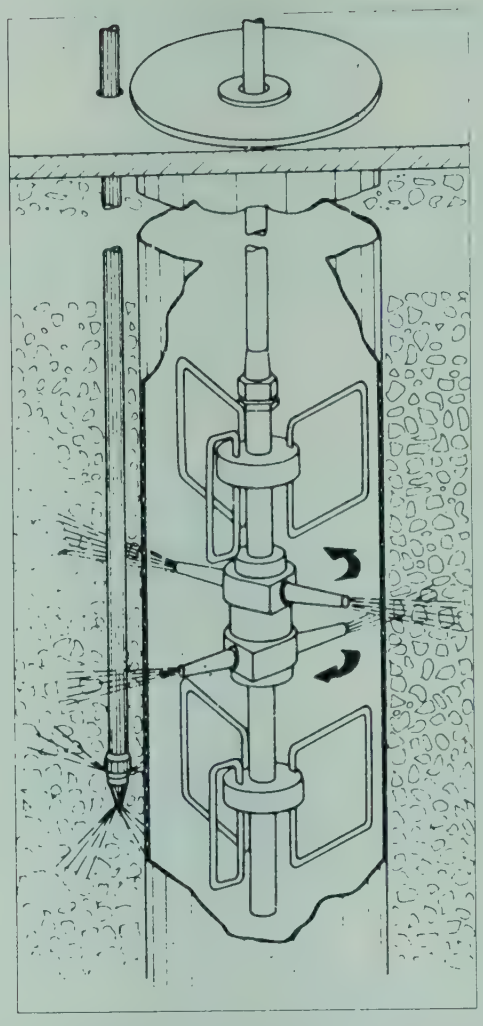
### Project Cost

*Equipment/machinery* : US$ 300,000
*Fees for technical knowhow/training* : US$ 150,000
*Operational cost* : US$ 600,000/year

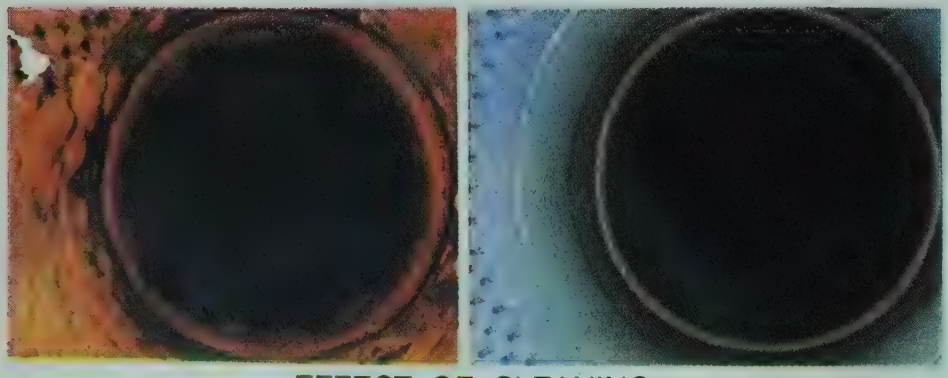
### Terms of Transfer

Licensing, turnkey

*Contact* : YVES BELLELI, GENERAL MANAGER, O&B ENGINEERING COATINGS LTD, P.O. BOX 3481, HAIFA 31034, ISRAEL



MULTI-ARMED CLEANSING TOOL WITH RADIALLY DIRECTED NOZZLES AND LANCES SUPPLIED WITH SPECIAL NOZZLES FOR CLEANING INSIDE AND FLUSHING OUTSIDE THE FOUNTAIN



EFFECT OF CLEANING

## DEEP WELL CLEANING

### Description

This technology uses high pressure water jets (~400 bars) to mechanically clean the perforation of the bore holes and clear clogged wells. In addition it is also possible to clean the filter bed around the well pipes by using lances with jets upto a depth of about 500m.

### Advantages

Simple and efficient process
No acidic pollution of ground water
Environment friendly
Low cost operation
Only solution to remove manganese clogging
System mobile.

### Areas of Application

Municipal water authorities. Other industries

### Stage of Development

Commercialised in Germany since 1986. Patented in Europe.

### Terms of Transfer

Subcontracting/Licensing

### Remarks

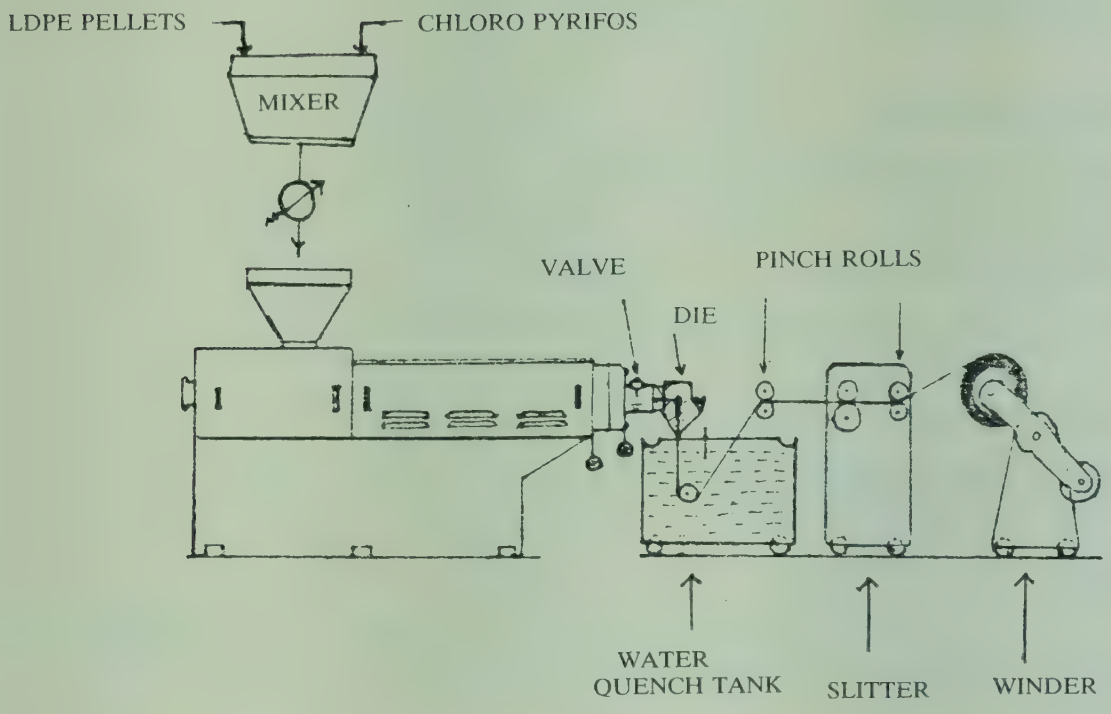
The technical assistance could be in the form of giving license in combination with the sale of the first set of the necessary equipment especially for territories far away from Germany.

### Project Cost

Equipment cost including certain spare parts for operating, documentation excluding the truck : DM 450,000

Training of operators on the job
(1 month) without travel costs : DM 25,000

*Contact* : POLITEC - W.L. POLEY, AM BEISENBUSCH 37, D-4270 DORSTEN, GERMANY ☐
TELEPHONE : 49-2326-3286☐ TELEX : 04 775380235 POLI ☐ FAX : (49 2362) 43286




A SCHEMATIC DIAGRAM

## FUMIGATION TECHNIQUE

### Description

In this technique LD polyethylene pellets are impregnated with chlorpyrifos insecticide. The chlorpyrifos -impregnated PE film thus produced is used as a protective cover for banana bunches, against insects and pests. The impregnating equipment can be locally fabricated and used with a standard blown film production line. The techniques conforms to International specifications.

### Advantages

Effective and efficient pest control mechanism.
Saves consumption of pesticides.
Ecologically cleaner process.

### Areas of Application

This technique is used in banana plantations and export packaging as well as for the safe growing and storage of different crops likely to be affected by insects.

### Stage of Development

Patented in USA - *The original technique was developed by another company and commercialized since 1970.*

### Inputs Required

*Raw Materials* : LDPE/chlorpyrifos/colour;
*Required Area* : Indoor - 200 sq.m.
*Manpower* : Skilled - 2, Unskilled - 7

### Project Cost

*Equipment/Machinery* : US$ 10,000
*Fee for technical know-how/training*: US$ 30,000

### Terms of Transfer

Technical consultancy, Turnkey

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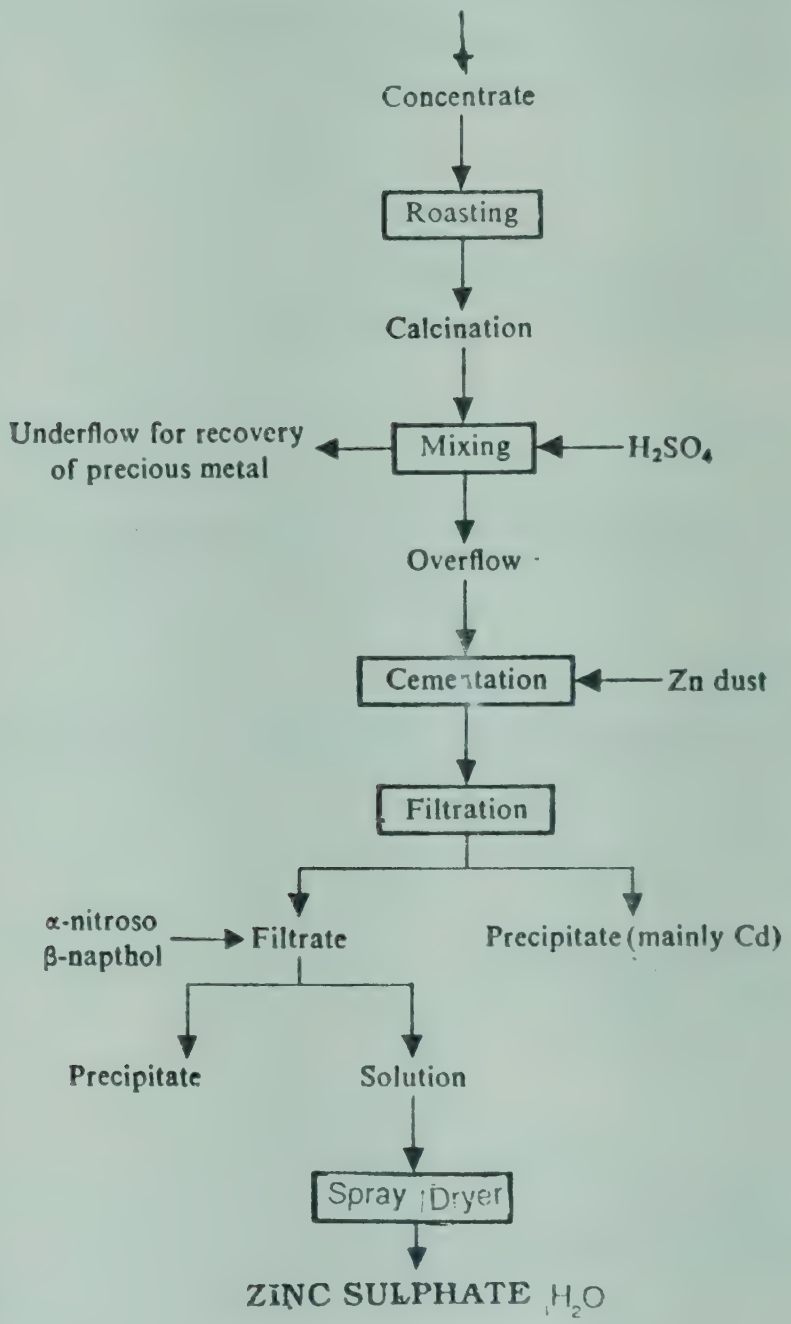
*Contact* : M.L.T. BAILLY, PRESIDENT, M/S. THE ATS CORPORATION, 7425 DEMOCRACY BOULEVARD, SUITE 15, BETHESDU, MARYLAND 20817, USA




FLOW SHEET FOR HYDROMETALLURGICAL EXTRACTION OF ZINC FROM WASTE MATERIALS

# INTEGRATED ZINC SECONDARY PLANT

## Description

The plant processes zinc secondaries to produce zinc sulphate heptahydrate or monohydrate with options to recover brass fines or copper. The process is a very efficient hydrometallurgical route involving operations like ball milling, tabling, cementation, reaction, filtration, evaporation/salting, crystallisation, centrifuging, pulverizing, seiving and ingotting (pyrometallurgical).

## Advantages

Utilization of industrial wastes.
Suitable for countries which have a supply-demand gap for zinc metal.
Zinc residues used as raw materials may be imported free or at a very low price.

## Areas of Application

Chemical and fertilizer industry.

## Stage of Development

Commercialised in India since 1984

## Production Capacity

(i) $ZnSO_4.7H_20$ - 2500 TPA; (ii) Cu 50% - 100 TPA; (iii) $Zn_7$, $Fe_2$, $Ca_4$, $S_5$ - 500 TPA

## Inputs Required

*Raw materials* : zinc wastes
*Utilities* : Power - 200 KW, Water - 3000 kl/yr.
*Required Area* : Building - 5,000 sq.m. Land - 10,000 sq.m.
*Manpower* : Skilled - 30, Technicians - 10, Unskilled - 100

## Project Costs

*Equipment/machinery* : US$ 500,000
*Operational cost* : US$ 300,000/year

## Terms of Transfer

Joint venture, turnkey, training

*Contact* : A.P. LEWIS, TECHNICAL DIRECTOR, SWATHY CHEMICALS LIMITED, 66, MOUNT POONAMALLEE ROAD, MADRAS 600 089, INDIA ☐ TELEPHONE: 434479, 434736 ☐ TELEX: 041-6902/8866 ☐ FAX: 91-44-865332/DEPT 58

PROTOTYPE FOR RECOVERY OF NICKEL FROM ELECTROPLATING WASTE

## METAL RECOVERY FROM ELECTROPLATING SLUDGES

**Description**

A clean technology known as diaphragm electrolysis has been tested to the prototype stage in the recovery of substantial amount of nickel metal which can be re-used directly in the factory or re-utilised in a purer form. Process applicable to other heavy metals such as zinc, copper and chromium.

Advantages:

Process simple, similar to electroplating and can be easily implemented.

Process eliminates sludge quanity;

Tremendous saving on sludge disposal and fixation costs.

Recovery of heavy metal to be re-used as raw material.

**Areas of Applications**

Electroplating factories (generation of sludge)

**Stage of Development**

Research projects

Heavy Metal Removal

Development of low-cost treatment technology as well as alternative processes for the recovery of heavy metals and disposal of sludges.

**Inputs**

a)Raw materials :Chemicals; b)Utilities ; Power :10.5 kwhr/kg of nickel recovered.

**No. of Employee(s)**

Skilled - 1

Project Cost (in US$ excluding land & building)

Rough estimate for recovery of nickel (660 kg/yr) in factory

a) Equipment/machinery (FOB : 25,000; b) Operational cost for one year : 10,000;
c) Saving/profit in nickel recovery : 10,000

**Ecological/Environmental Aspects**

Process eliminates considerable proportion (95%) of sludgewaste recoverable in heavy metals.

Terms of Transfer; Licensing; Sub-contracting

*Contact* : MS.LOOI HUP BOON. MARKETING & BUSINESS DEVELOPMENT UNIT. SIRIM. P.O.BOX-7035. 40911 SHAH ALAM. SELANGOR DARUL EHSAN. MALAYSIA. ☐TELEPHONE: 5592601 EXT. 2117 ☐ FAX: (603) 5509477

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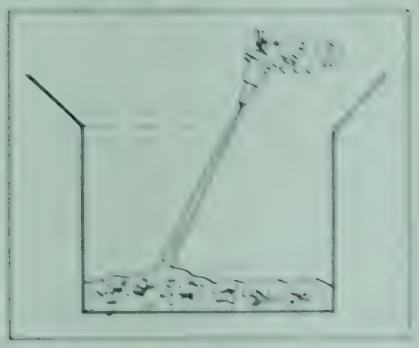
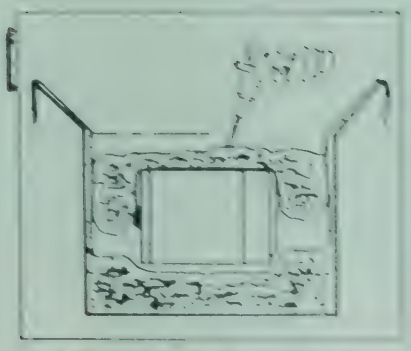
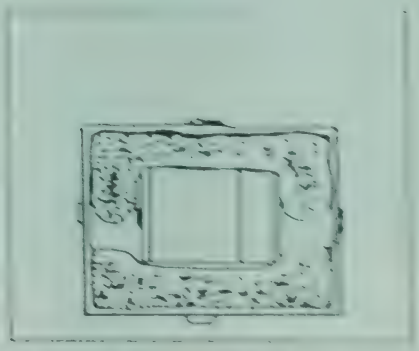






TYPICAL APPLICATIONS

# POLYURETHENE MATERIALS FOR ON THE SPOT PACKING

## Description

Polyurethene packing foam is the most effective foam to protect commodities against shocks, and vibration in transportation. The specific gravity of the packing foam is from 8 to 12 kg/m3 in order to meet packing demands for various kinds of commodities.

## Equipment/machinery

The whole equipment consist of a electrical (air-power) mixing pump, house, automatic gun and container for chemical liquid (the container standing area is not more than one sq.km.). The equipment/machinery must be equiped with 220 v/30 A single phase AC power, proportion of two materials is 1:1.

## Technical specification

In accordance with U S A International Packing System Standard (I.P.S). The technological parameter of TR250 model foam as follows:

1) Materials A Composition : ( ISOYANAE) MDI CRUDE; B Composition : POLYOL RESIN; 2) Specific gravity per cubic foot(pound):.53 ± 03; 3) Foams from one pound liquid (cubic foot) 1.64; 4) Pressure strength of the foam (PSI) 2.6; 5) Flash point of the liquid - A Composition 400F; B Composition : 400F; 6) Chemical combination rate of the liquid (%) 87; 7) Time of emulsification (second) : 8-10; 8) Time of foaming (second) 25 ± 5; 9) Time of deviscosity (second):30 ± 5; 10) Recovery rate after 50% pressing down (%) 6; 11) Liquid expansion rate (time) :132.

## Advantages

The technlogy is most advanced in the world, and possess a lot of advantages such as no poison, safety, convenient operation, simple structure, small standing area and inexpensive etc.

## Areas of application

The packing technology can be used to pack various shapes of products such as arts, antiques, furnitures, fragile commodities, machinery, plane spare parts, military equipments precise instruments, glass wares, medical equipments, optic instruments and clocks etc.

## Stage of development

The technology has been commercialized since 1985 in the Peoples' Republic of China.

## Production capacity

The price per one cubic meter foam : US$ 46 (in China)

## Inputs

1) Raw materials A Composition: (ISOCYANATE) MDI CRUDE;BComposition POLYOL RESIN , 2) Utilities : Consumption of water and fuel : Nil; Electrical powe rMax. 3.3 kw; Pressure air 6.5-8 kg/cm2; 3) Required space : 1) Indoor:50 sq. m;4) Manpower : Skilled :1; Unskilled:2

## Project costs

1) Equipment/machinery : US$ 25,000; 2) Fees for technical know-how/training : US$ 100,000

## Terms of transfer

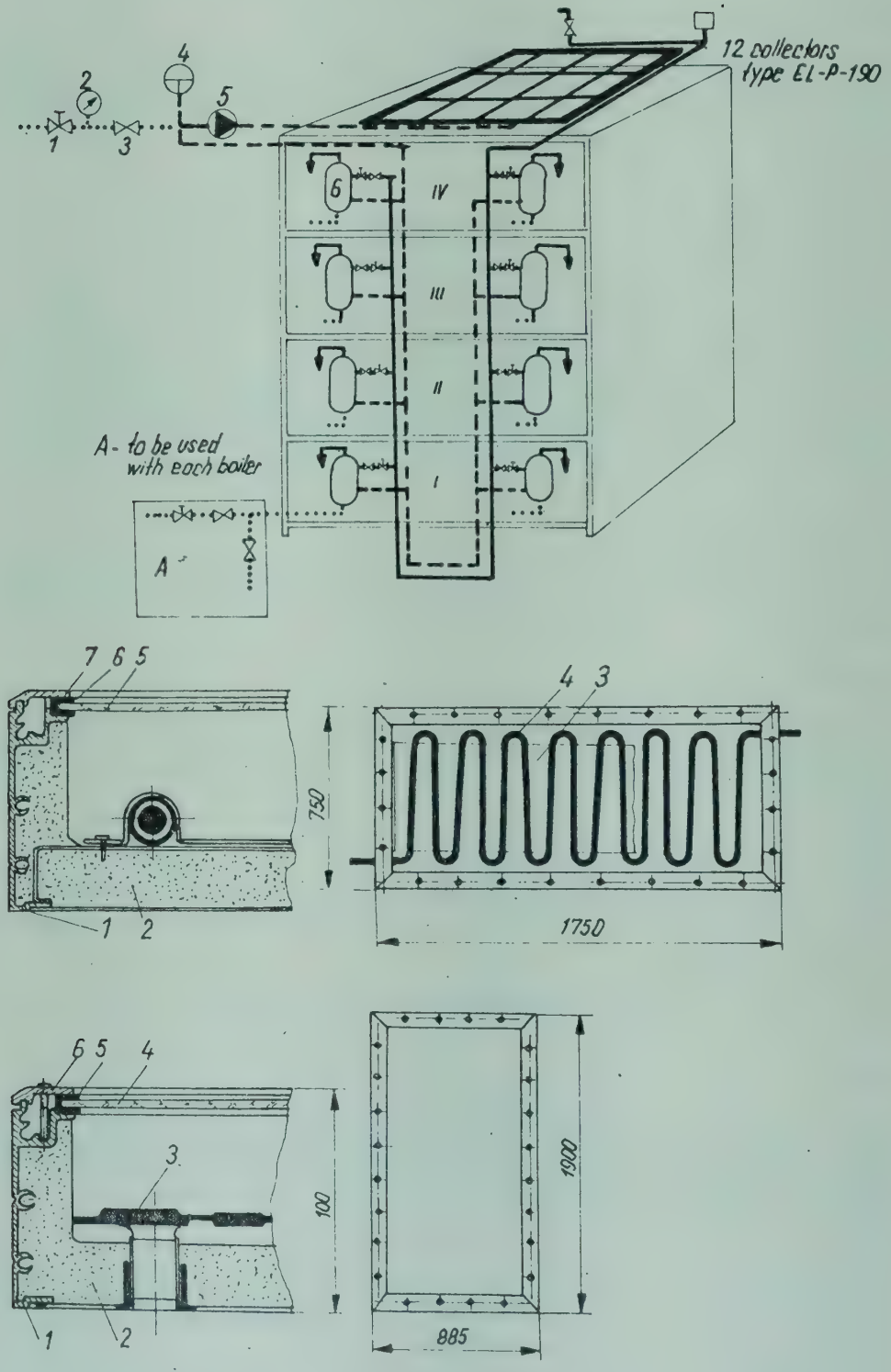
Turn-key

*Contact :* CHINA SHENYANG POLYURETHANE CHEMICAL INSTITUTE JIUZHAN, DONGLING DIST. IN THE SHENYANG PETROCHEMICAL PLANT, SHENYANG, CHINA

**Legend (I)**
1 — Slide valve
2 — Pressure regulator
3 — Non return valve
4 — Expansion vessel
5 — Boiler 120 litres

**Legend (II)**
1 — Collector housing
2 — Insulation
3 — Absorber
4 — Tubular register
5 — Absorber cover
6 — Rubber packing
7 — Bounding strip

**Legend (III)**
1 — Collector housing
2 — Insulation
3 — Absorber
4 — Absorber cover
5 — Rubber packing
6 — Bounding strip




SOLAR COLLECTORS

## SOLAR COLLECTORS PRODUCTION PLANT

### Description

The technology enables production of flat plate and tubular solar collectors. The collector has the following main parts : absorbing box (collector housing) insulation, absorbing plane and cover. The tubular collectors are said to be simple and suitable for house installation for thermosyphonic water heating without using circulation pump. The flat plate collectors are suitable for hotels and other community buildings.

### Advantages

No pollution of the environment

Water heating in houses and community buildings

### Stage of Development

Commercialised

### Project Cost

US$ 350,000; Estimated Technological Plant Cost : US$ 250,000; Area : 1,500 sq. m; Employees : Skilled-4; Unskilled-90

Additional Information :

- Dimensions
- The flat Plate collector
- Collector housing 1,900 x 885 mm
- Boiler 100
- The tubular collector 1,750 x 740
- Solar boiler 120 lts

### Terms of Transfer

Turnkey/engineering

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*Contact* : RESEARCH CENTRE FOR COOP WITH DEVELOPING COUNTRIES, P.O. BOX 97, 61109, LJUBLJANU, SLOVENIA

SOLADYNE SOLAR COOKER

## SOLAR COOKER

### Description

The unit is a concentrator type solar cooker. It consists of a 48" dia Fresnel type reflecting lens, a stand, and a pot holder. The lens can be adjusted from horizontal to 45° in all directions. The potholder moves separately from the lens, and remains in a level position. In direct sunlight the lens will bring a litre of water at 75°F to boil in about 14 minutes. This time varies from 12 to 17 minutes, depending upon the latitude and season of the year. In the focal region, the heat is sufficiently intense to fry eggs, meats, etc. in roughly the same time that is required when using a small burner on an electric stove. The unit when dis-assembled can be packed in a 24" x 24" x 10" carton. The present model is made of steel polyester sheet with vapour deposited aluminium as the reflecting material which covers the lens.

### Advantages

Use of solar energy hence

(i) environment friendly

(ii) no deforestation

Fuel free

Sturdy module

### Areas of Application

In areas that are experiencing deforestation, or where forests have been eliminated.

### Stage of Development

Patented in 1989 in the U.S.

### Inputs required

*Raw materials* : sheet steel or sheet aluminium and steel tubing. Steel is plated with either tin or zinc; a 400 ton hydraulic press is required to form the lens quadrants.
*Required area* : Indoor - 700 $m^2$

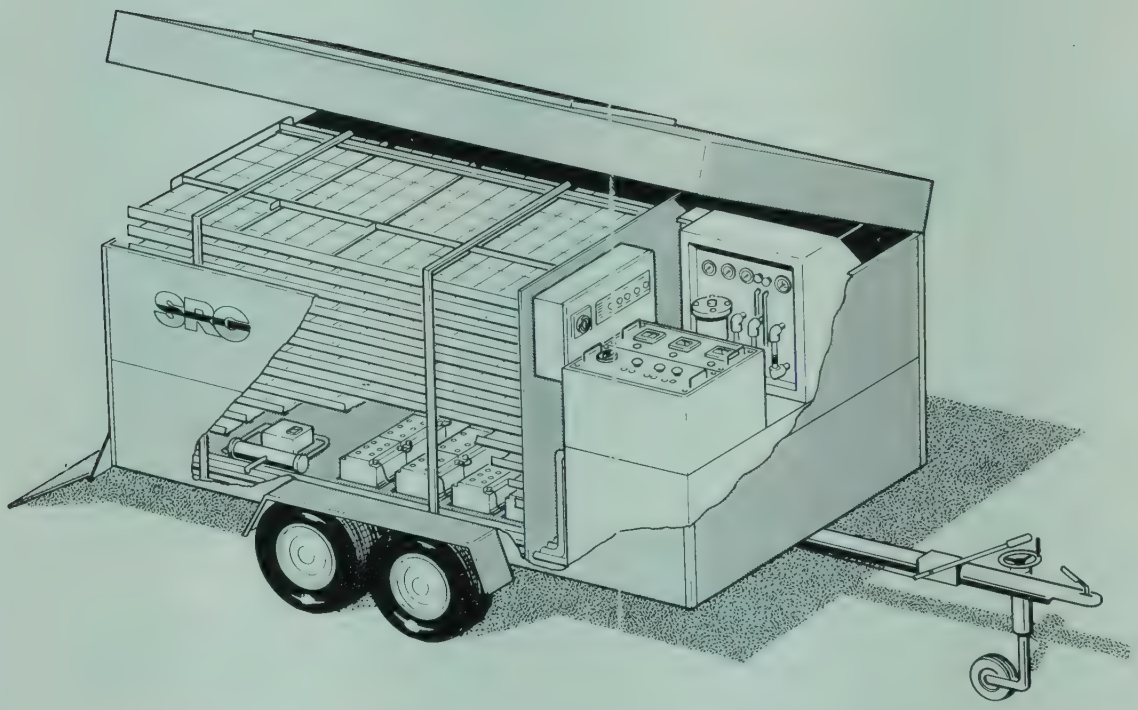
### Project Cost

*Equipment/Machinery (FOB)* : (Dies and Tooling) - US$145,000
*Operational cost for one year* : Depends on labour cost

### Terms of Transfer

Licensing, Sub-contracting, Joint Venture, Turnkey

*Contact* : JOHN B. LONG, 988 BLVD. OF THE ARTS, #212 SARASOTA, FLORIDA 34236, U.S.A. ☐
TELEPHONE : (813) 954-6562



A CUTAWAY VIEW OF A DESALINATION UNIT

## SOLAR DESALINATION PLANT

### Description

This water desalination unit works using the reverse osmosis principle and is powered by photovoltaic solar panels. It is a stand-alone system that can be put up in any place where no drinking water is available. Capacity is 1,000 litre/day, so that 300-400 people can be supplied with wate.

### Advantages

Handy in relief work in the event of natural calamities.
Renewable energy utilization.
System can also be used for waste water treatment.
Mobile and can be transported easily.

### Areas of Application

Everywhere where drinking water is needed, especially in rural areas with no infrastructure and no electricity.

### Stage of Development

Pilot plant

### Inputs Required

*Utilities* : Power - Solar, Water - Sea, river and waste water

*Required Area* : Land - 200 sq. ft.

*Manpower* : Skilled -1

### Project Cost

*Equipment/machinery* : US$ 100,000
*Operational cost* : US$ 2,000/year

### Terms of Transfer

Negotiable

*Contact* : JOHANNES WEYANDT, TECHNISCHER L;EITER, SRG SCALTANLAGEN GMBH, ROTENBERGSTRASSE, D-5506, ZEMMER 1, GERMANY ☐ TELEPHONE : (0 65 80) 593 ☐ FAX : (0 65 80) 590

TYPE I

TYPE II

SOLAR STILLS

## SOLAR DISTILLATION

### Description

These solar stills come in two types. The first one is the simple still made of ordinary glass and stainless steel sheets (0.4 mm thick) insulated with polystyrene foam. The distillate trough is made of glass strips joined together with silicon rubber to ensure effective contact with distillate. The still requires an area of 1.5 sq.m./unit and still roof is $13^{\circ}$ in slope of 2 mm thin glass sheets. Rice husk ash is used as solar energy absorber. Production rate is 2.8 litres/sq m./day. The second type is the tilted tray made from glass sheets & asbestos cement sheet insulated with polystyrene foam which has higher efficiency than the simple still but it is not found suitable if the water has high hardness.

### Advantages

Renewable energy utilization technology. Rice husk ash, an agro-waste, is used as solar energy absorber. Durable. Light-weight. Low operational and maintenance costs.

- No energy consumption (except in some case energy may be needed for pumping water into the still)
- Light in weight (not more than 50 kg per square meters) which makes it possible to install on roof of the building
- Product (distillate) consistent in quality and very pure (except aerobic bacteria may be found in the distillate storage tank)
- Durable (life time more than 15 years) and low maintenance cost (less than 1% of installation cost)
- No operational cost

### Areas of Application

Pharmaceutical and acid-battery industries, drinking water supply facilities.

- Pure water for laboratory uses
- For industry (especially pharmaceutical, acid battery)
- For drinking purposes

### Stage of Development

Commercialized in Thailand since 1981

### Inputs Required

*Raw materials* : Tap water, underground water or even sea/salty water, rice husk ash.

### Project Cost

*Installation cost* : US$ 200; *Training* : US$ 2,000; *Operational cost* : US$ 10/unit/year.

### Terms of Transfer

Subcontracting

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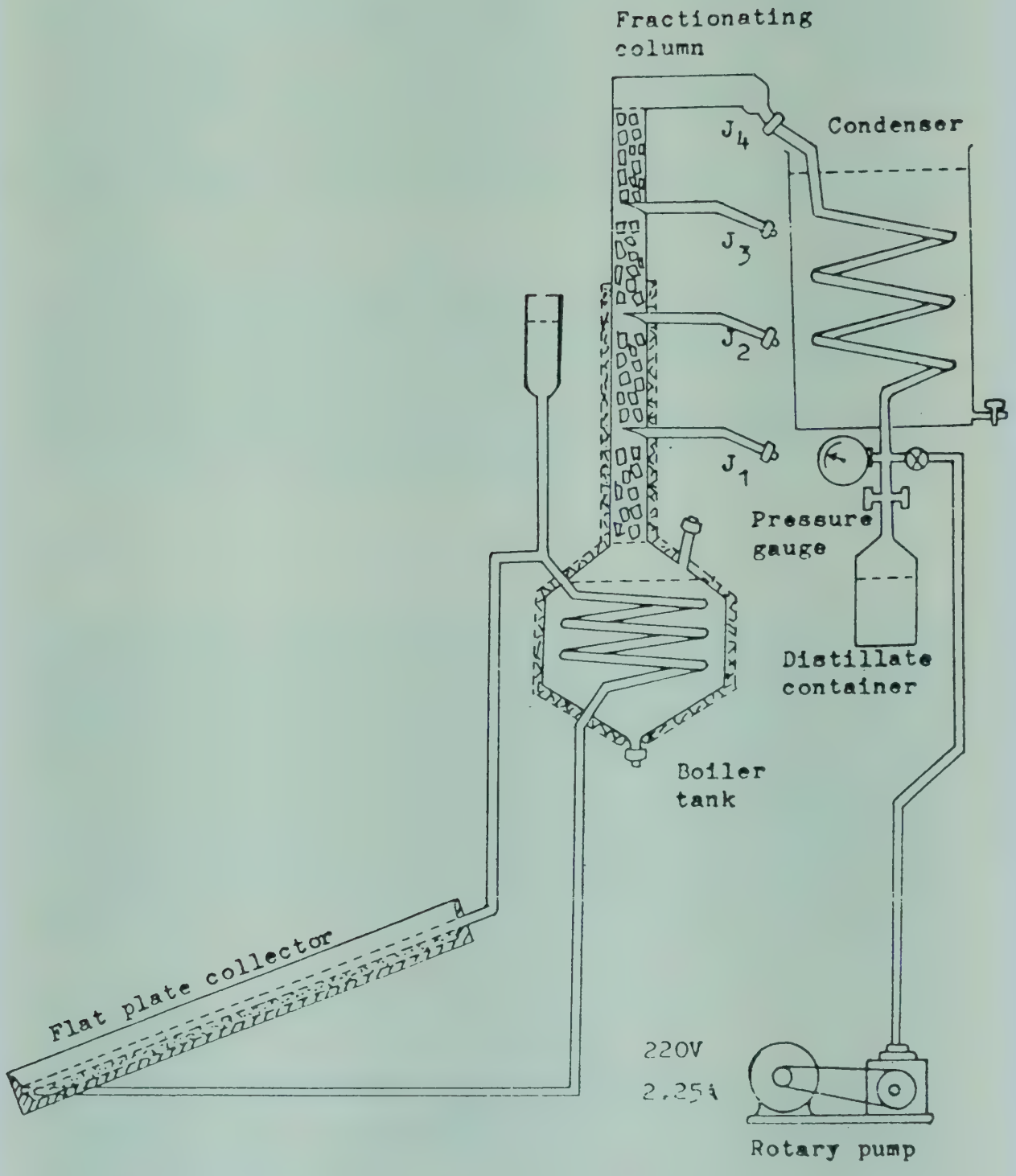
*Contact* : KASEM SNIDVONGS, DIRECTOR-GENERAL, DEPARTMENT OF SCIENCE SERVICE, THAILAND
☐ TELEPHONE : 245-0009; 246-0065




DISTILLATION PROCESS

# SOLAR DISTILLATION STILL FOR ALCOHOL

## Description

It is a low pressure still of the fractional type, consisting of a 1.1 m high fractionating column, a 25 litre boiler tank and a 1.4 sq.m flat plate collector. The distillation process requires thermal energy in the temperature range of 50-80°C , either from the sun or other sources. Yield can be as high as 92% (v/v).

## Advantages

Energy consumption is mostly solar energy. Any other heat source (50-80°C) can also be used instead.

## Areas of Application

Alcohol distillation

## Stage of Development

Pilot Plant

## Inputs Required

Locally fermentable materials

## Production Cost

*Equipment/Machinery (FOB)* : US$ 750 - 3,000

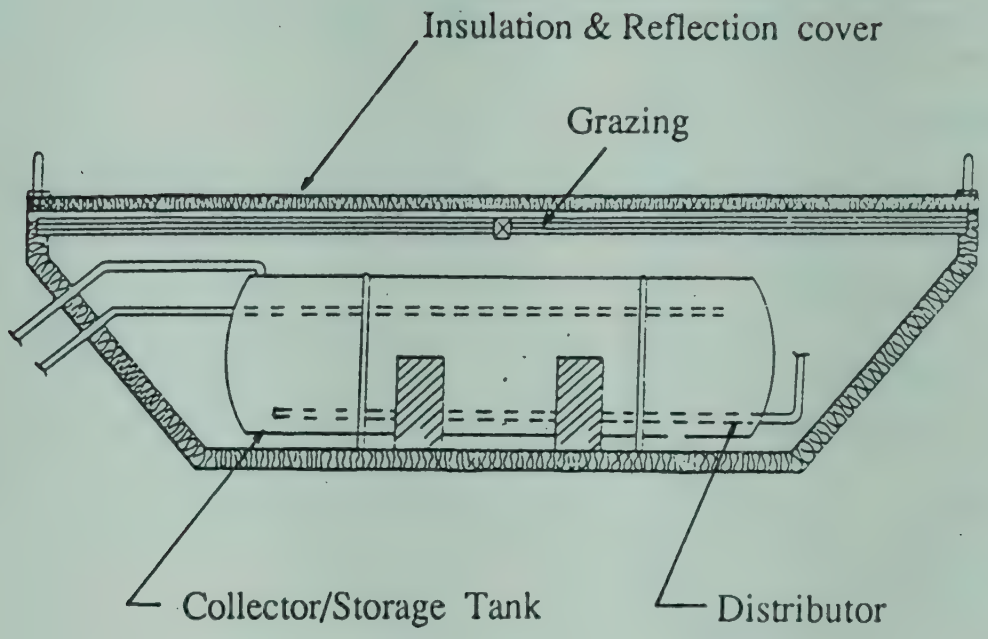
Specifications :

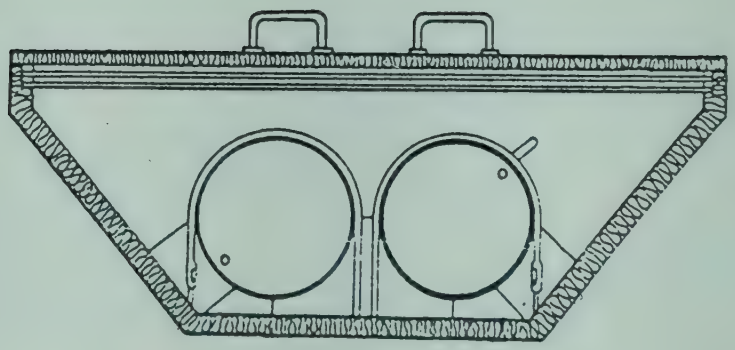
| | | |
|---|---|---|
| Boiler capacity | : | 25 lit. |
| Yield concentration (max.) | : | 92 % (v/v) |
| Flat plate area | : | 1.4 sq.m. |
| Column height | : | 1.1 m. |
| Working temperature | : | 50-80°C |

## Terms of Transfer

Licensing; Consultancy

*Contact* : DR NIKORN MANGKORNTONG, DEPARTMENT OF PHYSICS, FACULTY OF SCIENCE, CHIANG MAI UNIVERSITY, CHIANG MAI 5002, THAILAND



SYSTEM FRONT AND SIDE ELEVATION

## SOLAR HOT WATER SYSTEM

### Description

Collector/storage type solar water heater. Stepwise tank array in order to increase thermal stratification (System front and side elevation).

### Advantages

* High efficiency, low cost, compact solar water heater
* Convenience of manufacture and installation
* Simplicity of operation and usage
* Low management and maintenance expenses

### Areas of Application

* Residential housing and building (individual, multi-family, apartment)
* Office buildings
* School buildings
* Dormitory
* Military barracks

### Stage of Development

Patented

*Contact*: SOLAR ENERGY DEPT, KIER, P.O. BOX 5, DAE-DUCK SCIENCE TOWN, DAE JEON, CHUNGNAM, REPUBLIC OF KOREA ☐ TELEPHONE : (042) 861-9700-8

SOLAR LANTERN

## SOLAR PHOTOVOLTAIC ENCAPSULATED PANELS

### Description

This process consists of encapsulation of the cell string in a material called (Ethylene Vinyl Acetate) and sticking it to a single sheet of glass. This state-of-the-art process involves lamination, crucial to the proper encapsulation of cells.

### Advantages

No sandwiching of the cells string between two glass sheets in a silican encapsulant. This process is costly and technologically prone to problems due to the nature of the silicon curing process.

### Cost effective

Improved product efficiency through better refractive index matching

### Areas of Application

These modules are used in a wide range of solar powered systems and devices

### Stage of Development

Commercialised in India

### Operation :

(1) Cell sorting (2) Tabbing, stringing and chaining; (3) Module testing and performance monitoring under simulated sunlight conditions

Equipment : (i) Laminator; (2) Cell sorter; (3) Module Tester; (4) Tabbing, Chaining and stringing fixtures.

*Raw Materials* : (1) SPV Cells; (2) Tempered white glass; (3) Tedlar sheet; (4) Ethyl Vinyl Acetate; (5) Crane Glass; (6) ETC 732 Silicone; (7)Copper Strip; (8) Channel; (9) Terminal Box; (10) Labels; (11) Solder

### Project Cost :

Equipment/machinery (FOB) US$ 130,000; Fees for technical now-how/training US$ 40,000.

### Terms of Transfer

Turnkey

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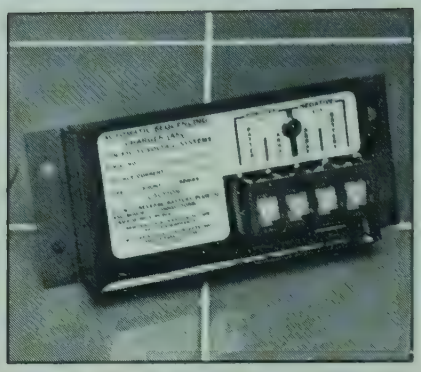
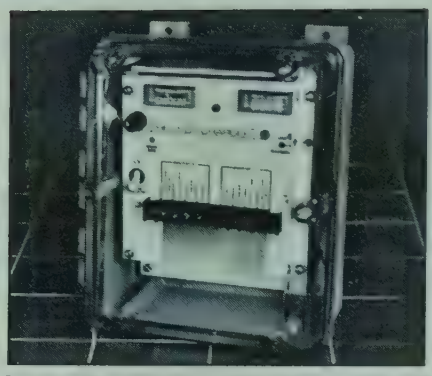
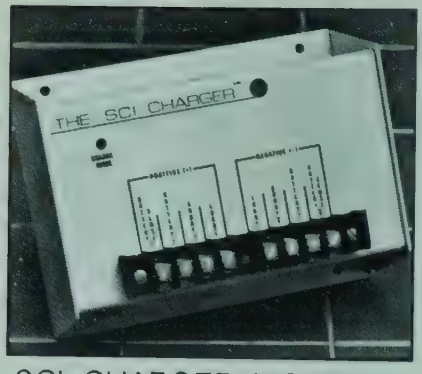
*Contact* : P. SURYANARAYAN, RENEWABLE ENERGY SYSTEMS (P) LTD., 6-4-481/2, KRISHNANAGAR COLONY, OPP. MUSHEERBAD JAIL, SECUNDERABAD 500 380, INDIA



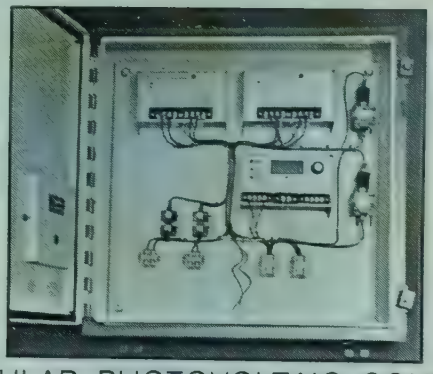
AUTOMATIC SEQUENCING CHARGER



PHOTOVOLTAIC POWER CONTROL (PPC)




SCI CHARGER MODEL 2



MODULAR PHOTOVOLTAIC CONTROL (MPC)

ASC WITH E OPTION

BATTERY SAVER

A SAMPLE OF REGULATORS AND SYSTEMS

## SOLAR PHOTOVOLTAIC REGULATORS AND SYSTEMS

### Description

A complete range of photovoltaic systems such as solar battery charge regulators and systems controls. The controls include various combinations of standard and optional features such as charge regulations, low-voltage load disconnect (LVD), system monitoring, reverse current leakage protection, over-current protection, mounting options, load control, central wiring, etc.

### Advantages

- Plastic Injection Moulding Machines
- Chemical Process Equipments
- Punch Presses and Blowers
- Planning and Shaping Machines
- Machine Tools/Motor Generator Welding Sets

### Areas of Application

Rural areas that require small-scale electric power systems for lighting, communications and health care services.

### Stage of Development

Commercialized in USA since 1981

### Terms of Transfer

Negotiable

### Remarks

Photo Voltaic controls offer various combinations and optional features. These features include -

(i) Charge regulation - to reduce water loss and damage to batteries due to overcharging
(ii) Low Voltage Load Disconnect - to reduce damage to batteries due to deep discharging
(iii) System Monitoring Instruments
(iv) Reverse Current Leakage Protection
(v) Over Current Protection
(vi) Local Control and Central Wiring

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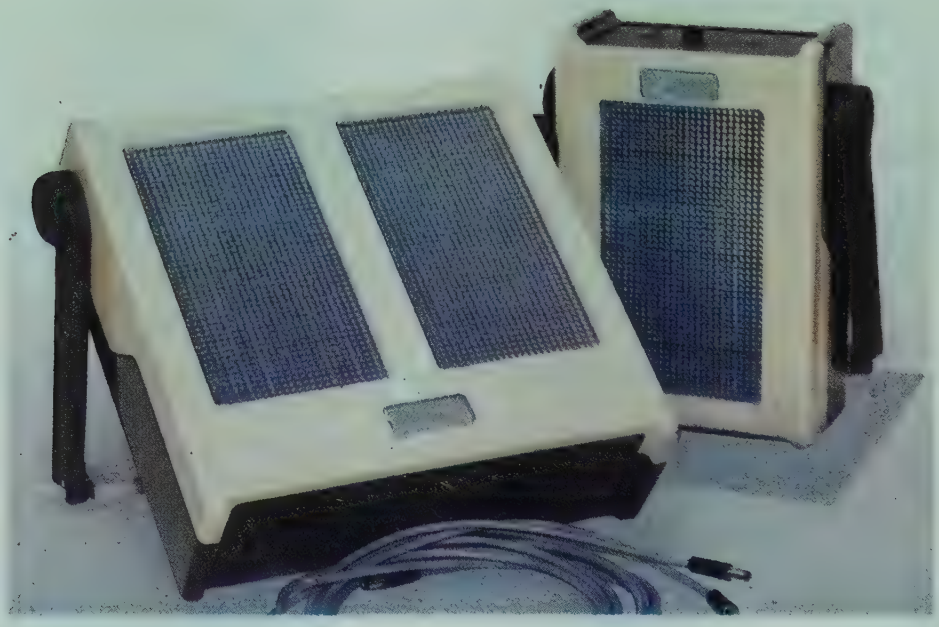
*Contact* : TOM PHILIP, SPECIALITY CONCEPTS INC, 9025 ETON AVE.,CANOGA PARK, CA 91304, USA ☐ FAX : (818) 998-5253



MODELS OF PORTABLE POWER SYSTEMS

## SOLAR PORTABLE POWER SYSTEM

### Description

Solar Power consists of a solar module, a charge regulator and Nicd batteries joined in compact case. The Low cost solar generator to power mobile consumer equipment. The equipment can be used independently from the main voltage or batteries. The systems are made from strong plastic, it is light, handly and robust.

### Advantages

Solar energy is free. It is an excellent devise to power portable equipments. The device can also be powered by Nicd batteries and these batteries are charged by sun. Therefore it can be used during the night and it is maintenance free. The large battery capacity ensures a large back-up.

The features of the system are :

- electric power wherever it is needed; simple to carry by compactness
- no batteries needed anymore; no maintenance

### Areas of Application

Electronic consumer goods such as :

- radio
- cassette recorder
- cameras
- walkman
- communication systems
- outdoor clocks
- toys

This is an excellent solution for all portable application.

### Operation

Temperature range :-20°C to +60°C

Solpower can withstand UV radiation and operation under tropical conditions and has a 2 metre long cable with connector.

### Electrical data

| | SP6 | SP12 |
|---|---|---|
| Rated voltage | 6V | 12V |
| Storage capacity | 2.6Ah | 4.0Ah |
| Charging current* | 0.2A | 40.2A |
| Dimensions | 215x140x75mm | 236x236x80mm |

* solar radiation 100 mW/cm$^2$ (25 c C/AM 1.5)

### Stage of Development

Commercialised

### Inputs

Small solar cells

### Terms of Transfer

Turnkey

*Contact* : SOLPRO SESNV, Mr. AD DE RON, BOCKTERHEIDE 30, 3540, ZOLOER, BELGIUM

A CEILING SUSPENDED LUMINAIRE

## SOLAR POWERED ELECTRIC LUMINAIRE

### Description

Consumer, product primarily for non-electrified homes; ceiling suspended to illuminate central table to 200 lux and to provide background room illumination 2-3 hours/night; contains batteries for use during cloudy periods; uses 10 watt photovoltaic panel.

### Advantages

High quality illumination with easy "Switch Operation"; no dependence on lighting fuels; low maintenance cost only replacement of battery every 3-5 years; battery charge/discharge management circuit assures maximum battery life; life cycle operating cost approx US$ 0.80/week.

### Areas of Application

Lighting homes, modifications for use in shops, offices, clinics, schools, governments and religious buildings.

### Stage of Development

Commercialized since 1985 in USA.

### Production Capacity

500 plus/year - Expect price of about $300/- when assembled in developing regions.

### Inputs Required

P.V. Panel, batteries, electronic components, wood and aluminium

Negligible utility needs; operations could be solar powered.

### Project Cost

Equipment/machinery (FOB) $2000/-. $ 10,000 minimum; Fees for technical know-how $ 1500/- minimum. Operational cost for one year $15,000/- minimum.

### Terms of Transfer

Licensing

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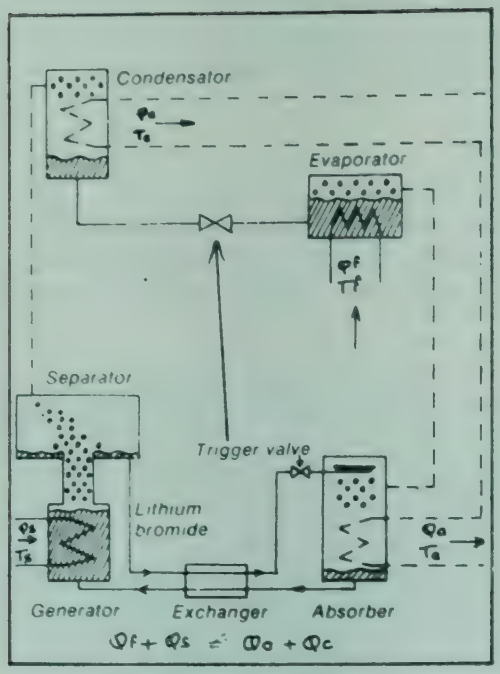
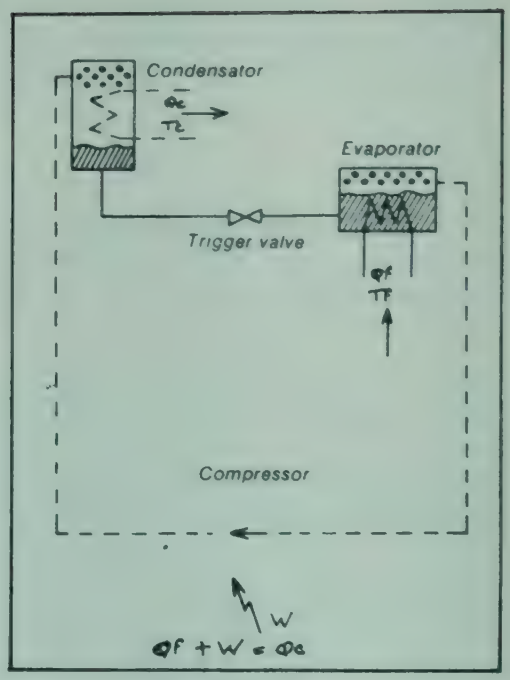
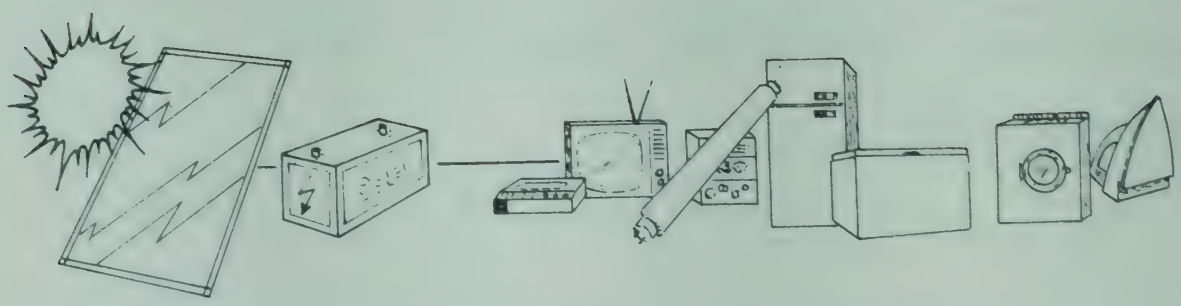
*Contact :* CURRIN CORPORATION, ATTN : C.G. CURRIN, P.O.BOX 1191, MIDLAND, MI 48640 ☐ TELEX : 271203 CURRN UR USA




ABSORPTION CYCLE




COMPRESSION CYCLE



RANGE OF UTILITIES POWERED BY SOLAR ENERGY

## SOLAR REFRIGERATOR AND FREEZER

### Description

The product was designed specifically for the Polynesian environment, which is not the case for the products marketed at Papeete, as follows:

* Improved thermal insulation to adapt it to ambient conditions (26 degrees C is the annual average)
* All-polyester construction to eliminate metal corrosion problems.
* The mains-powered version is designed for 220 V/60 Hz, whereas many tradesmen sell American 110 V/60 Hz or European 220 V/50 Hz models.

### Advantages

The Peltier effect employs a direct current flowing through a heterogeneous circuit, certain of whose welds are the seat of heat absorption whereas the others give up heat. Merely reversing the direction of the current causes this phenomenon to be reversed, so that a given chamber can be either cooled or heated. This method is restricted to very low powers.

For reasons of economy and efficiency, the classic compression cycle has finally prevailed, using a suitable source of direct current such as a storage battery. This being so, photocells are an efficient way of recharging such batteries.

### Areas of Applications

Domestic; Commercial

### Stage of Development

Commercialized in 1983

### Inputs

Utilities : Sunlight

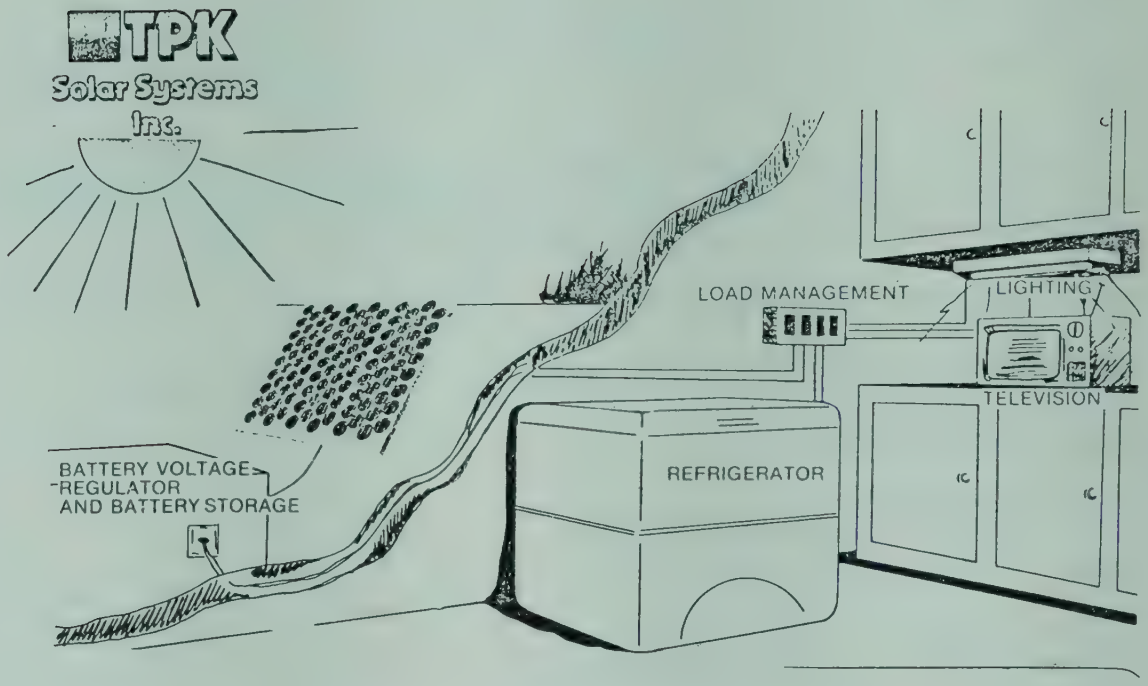
### Project Cost

Cost of the installation: US$ 900 (for a fare with 5 lamps facilities)

Cost of the installation: US$ 9000 ( for a fare with all amenities)

### Terms of Transfer

*Contact* :C.E.A (ATOMIC ENERGY COMMISSION). B.P.519. PAPEETE. TAHITI




REMOTE HOME POWER SYSTEMS

## SOLAVOLT SYSTEM

### Description

Equipment designed and custom-build to suit the environment of application. Vaccine coolers made to the specifications of World Health Organisation. Other equipment made to Canadian, US and British Standards.

Solavoit is dedicated to offering solutions which satisfy a variety of customer requirements from providing economical, reliable power for a radio repeater station on a mountaintop in Alaska to supplying the basic electric power needs for entire remote villages.

### Advantages

Renewable energy equipment would save fossil fuel and provide motive power where electricity supply is non-existent. Technology used is mostly intermediate and hence adaptable to materials and labour situations in developing countries.

### Areas of Applications

Anywhere a reliable, independent source of electricity is required, Solavolt can provide it for a variety of applications:

* Remote communications; Water pumping and irrigation; Offshore equipment; Corrosion protection; Rural electrification systems; Navigational aids; Remote medical refrigerators; Instrumentation and telemetry system; Utility interfaced power systems; Lighting; Forestry equipment; Emergency phones; Remote homes; Portable equipment; Railroad signalling

### Stage of Development

Patented in UK and Canada; Commercialized in UK and Canada

### Production Capacity

Recommended economic scale: US$ 50-100,000 for solar cooler & pump industry

### Inputs

*Water:* 40 gals./day; *Electricity*: 40 kw
*Manpower* : Skilled: 4; Unskilled : 12

### Project cost

*Equipment/machinery (FOB)*: Most of the manufacturing machinery would be made locally.
*Fees for technical know-how/training*: Nominal
*Operational cost for one year*: Depends on scale

### Terms of Transfer

Licensing; Investment; Joint venture; Turn-key

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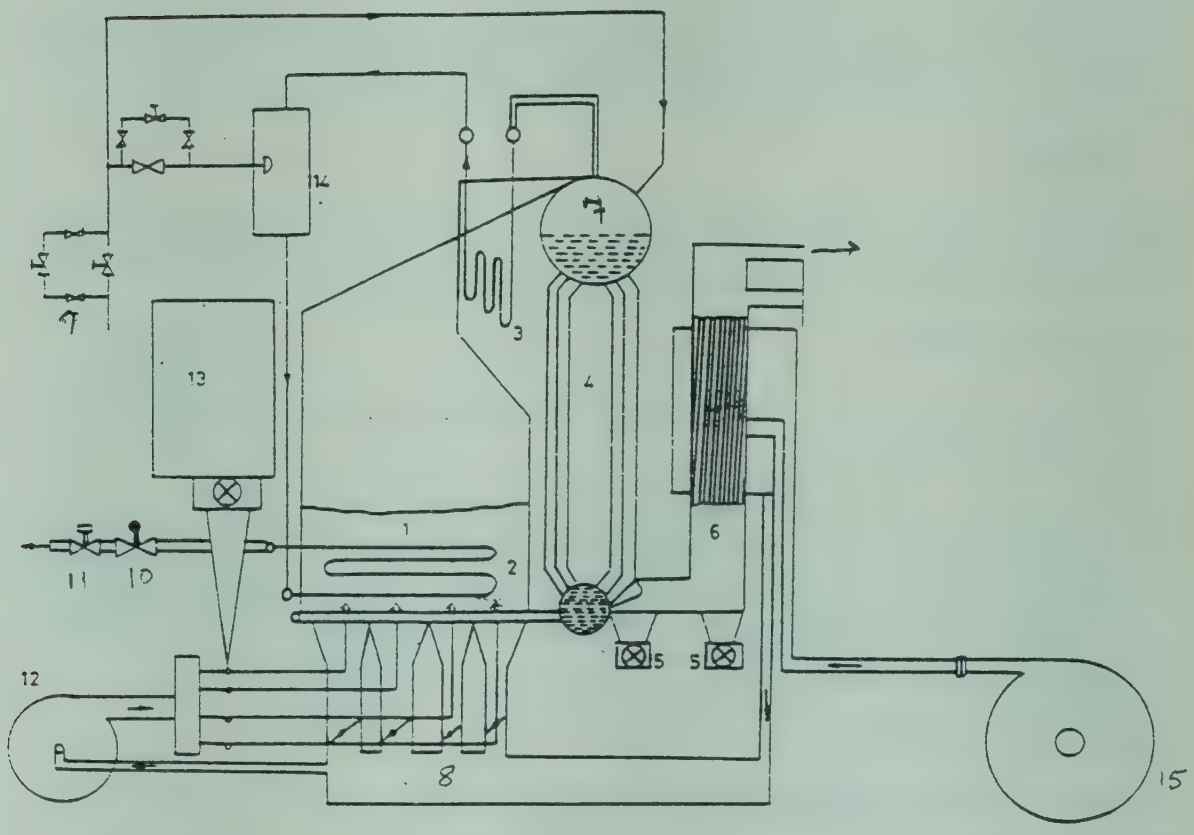
*Contact*: DR.ROBIN BASU, SOLAR ENGINEERING GROUP LTD., BOX-923, STATION M, CALGARY, ALBERTA T2P 2J6, CANADA TELEPHONE: (403)270-7100(B) TELEX: 03827506 PHYSICS




1. Fluidized bed
2. Bed coil (super heater)
3. Super heater - 2
4. Boiler bank
5. Bank hopper
6. Tubular air preheater
7. Steam drum
8. Air box
9. Feed water inlet
10. Start-up vent
11. Main stream stop valve
12. Pneumatic air fan
13. Coal bunker (400 T)
14. De-super heater
15. FD Fan

SCHEMATIC DIAGRAM

## CIRCULATING FLUIDIZED BED COMBUSTION

### Description

The three products are : Industrial Boiler, Power Station Boiler, and Hot Water Boiler. Their specifications are : 6 t/h, 1.25 MPs; 10 t/h, 1.25 MPa; 10 t/h, 2.45 MPa; 15 t/h, 2.45 MPa; 20 t/h, 3.82 MPa; 25 t/h, 2.45 MPa; 35 t/h, 3.82 MPa; 65 t/h, 3.82 MPa; 75 t/h, 3.82 MPa; 130 t/h, 3.82 MPa

### Advantages

The boilers are adaptable to different kinds of coals and can have different kinds of low grade coats.
Height heat efficiency - Combustion efficiency : 97.09%
Heat efficiency : 87.59%
Decreasing pollution.

### Areas of Application

As industrial steam to generate electricity and warmth

### Stage of Development

Commercialised since 1990 in China

### Inputs Required

*Raw materials* : steel
*Utilities* : Power - 1,330,000 kWh/annum; Water - 66 $m^3/h$
*Required area* : Indoor - 25651$m^2$; Outdoor - 100,749$m^2$

### Project Cost

*Equipment/Machinery (FOB)* : US$10,000,000
*Operational cost for one year* : US$1,000,000

### Terms of Transfer

Turnkey

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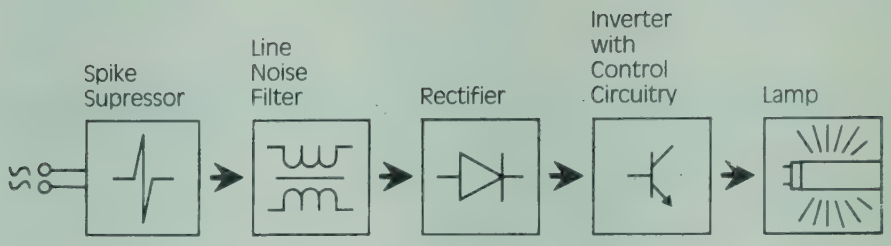
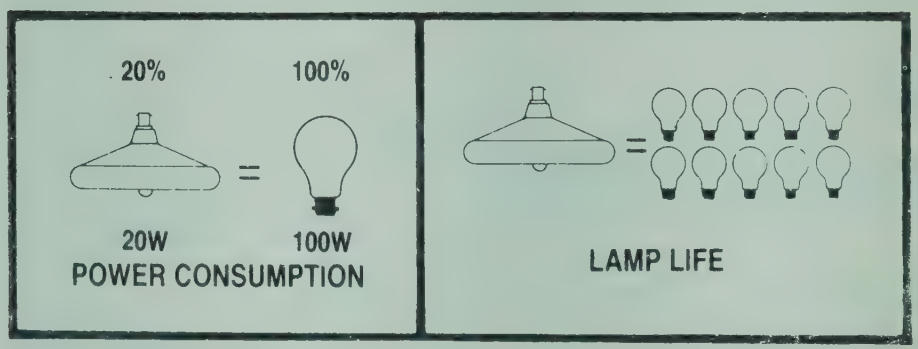
*Contact* : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245




BLOCK DIAGRAM OF THE ELITE ELECTRONIC BALLAST



# ELECTRONIC BALLAST FOR FLUORESCENT TUBELIGHT

## Description

Technology-basically electronic assembly for manufacturing high frequency, energy saving, electronic ballasts for different types of fluorescent tubelight. The company has developed the technology to manufacture electric ballast for fluorescent tubes of the following ratings.

1x20 W 2x20W 1 x 40W 2x40W; 1x65W 1x80W

- Advantages
- Energy saving to the tune of 37%.
- Instant Starter
- High Power factor i.e. 0.99 which reduces current and subsequent distribution losses.
- Low Voltage operation from 100V
- Wide operating voltage range i.e. 100V-270VAC
- Light weight and no flicker and doubles the life of the tube

## Areas of Application

Domestic, Industrial and Command area. To be used in place of conventional wire wound ballast of aluminium or copper for fluorescent tubes.

## Stage of Development

Commercialised

## Production Capacity

2 Million pcs.

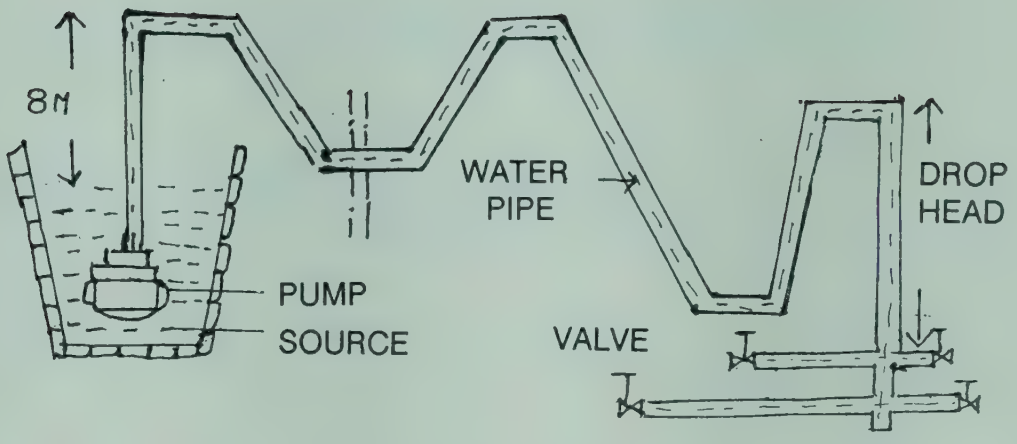
## Inputs :

*Raw materials* - Electronic components; *power* - 10 HP; Area required - Indoor 250 $M^2$ Outdoor - 500 $M^2$; No. of employees : Unskilled-3; Skilled-10; Tech staff-2

## Terms of Transfer

Licensing, joint venture and Turnkey.

*Contact* : MR. AJIT SHAH, YANTRA ELECTRONICS AND ELECTRICALS (I) PVT. LTD., 20 ROTI CHAMBERS, SADASHIV PETH, PUNE 411030, INDIA




FLOW DIAGRAM

## ENERGY-SAVING WATER DRAWING UNIT

### Description

The key element in the system, an energy-saving siphon-shaped water pump, is different from other kinds of pumps in structure. It can be set up in a serial connection and can be attached to any water pipeline of upto 50 cms in dia and tens of kilometres in length. This system can be operated by filling water to eliminate the air inside. There is no need for preliminary vacuum elimination by additional equipment. The pump can be made of different materials like - cast iron, cast steel, cast aluminium, stainless steel, plastic etc. The body of the pump is cylindrical and is connected with the flange plate. Its dia is about twice the maximum dia of the waterpipe connected, and its height is between 0.2 and 1.3 metres.

### Advantages

Quick and big flow.
Minimum breakdown.
Noiseless.
Small in size.
Manning not required
Easy to run.
Long-term benefit with one-time investment.

### Areas of Application

In any project where water drawing and oil transportation is necessary; can be used in long-distance waste-water draining from cities and enterprises; for underground water refillings for preventing earth subsidence, and for circulating water in industry.

### Stage of Development

Pilot plant and patented in China since January 1991

Inputs Required

*Land/Building* : Indoor - 800 to 1,500 sq.m.
*Manpower* : Skilled - 35-100; Unskilled - 15 to 30

### Project Cost

*Equipment/machinery* : About US$ 200,000
*Operational cost for one year* : About US$ 300,000/year

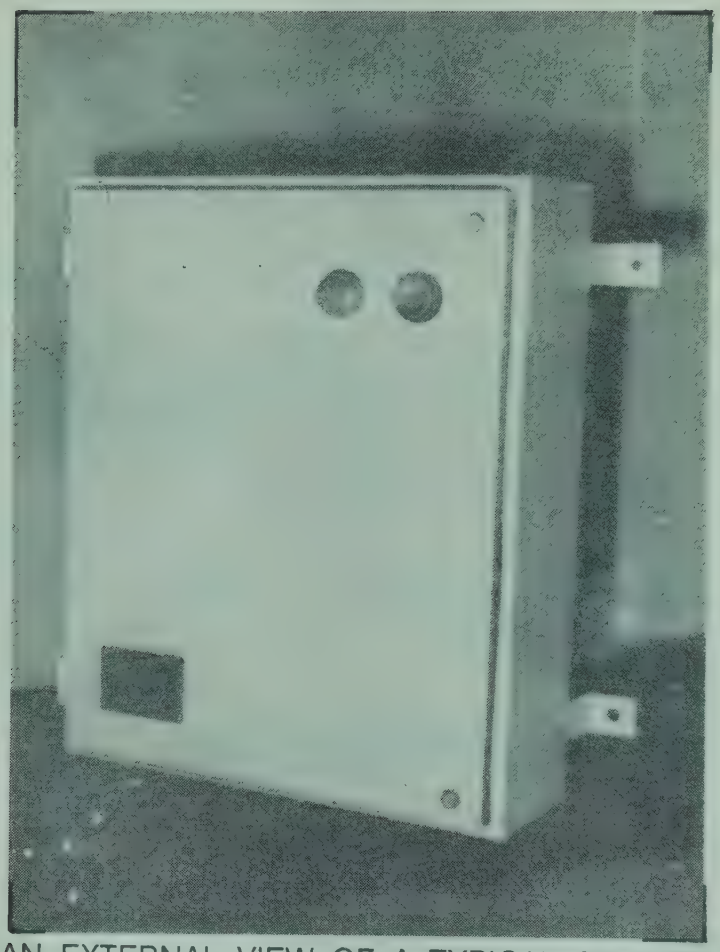
### Terms of Transfer

Licensing and sub-contracting

### Remarks :

There are five types of siphon-shaped water pumps. The WS-500 type indicates that the maximum diameter of the water pipeline connected to the water pump can be upto 0.5m. If the diameter of the pipeline is 4m, a suitable pump can be made by connecting four WS-1000 waterpumps in parallel with the water pipeline. Other types of water pumps can also be made on the same principle.

*Contact* : WEN YU BIN, DIRECTOR, KODE RESEARCH INSTITUTE OF PRECISE GRINDING TECHNOLOGY, 38, GU YONG XIANG,QUANZHOU, FUJIAN 362000, CHINA (P.R) ☐ TELEPHONE : 86-595-238257 ☐ FAX : 86-595-232476



AN EXTERNAL VIEW OF A TYPICAL STARTER

# SOFT START STARTERS AND ENERGY SAVERS

## Description

Soft start motor starters with energy saving facilities for induction motors upto 6000 HP and energy savers for welding sets. The device applies a gradually increasing voltage resulting in gradual accelration of the motor and once the motor reaches full speed, it automatically regulates the voltage applied to the motor to that required to meet the torque without sacrificing its performance. The data on savings obtained under actual working conditions confirms its utility.

## Advantages

- Gradual acceleration of motor and consequent elimination of shocks during starting (soft start)
- Reduced power consumption
- Improvement in power factor
- Reduction in maximum demand
- Reduced peak current during starting
- Reduced motor temperature

## Areas of Application

Plastic Injection Moulding machines; Chemical Process Equipments; Punch presses and blowers; Planning and shaping machines; Machine Tools/Motor Generator welding sets

Energy savers and soft start starters can be used in any industry where electric motors, induction motors or welding sets are partially or cyclically loaded.
Soft start starters can be used very effectively where gradual starting is needed, for example in textile mills (textile industry), etc

## Stage of Development

Commercialized in India

## Production Capacity

250 pcs a year

**Inputs Required** *Raw materials* : **Thyristors, integral schemes, electronic components and parts, heat sinks and steel enclosures;** *Utilities* : **Power - 30 KW.** *Required Area* : **Indoor - 300 sq.m.** *Manpower* : **Skilled - 10; Technicians - 6, Unskilled - 10.**

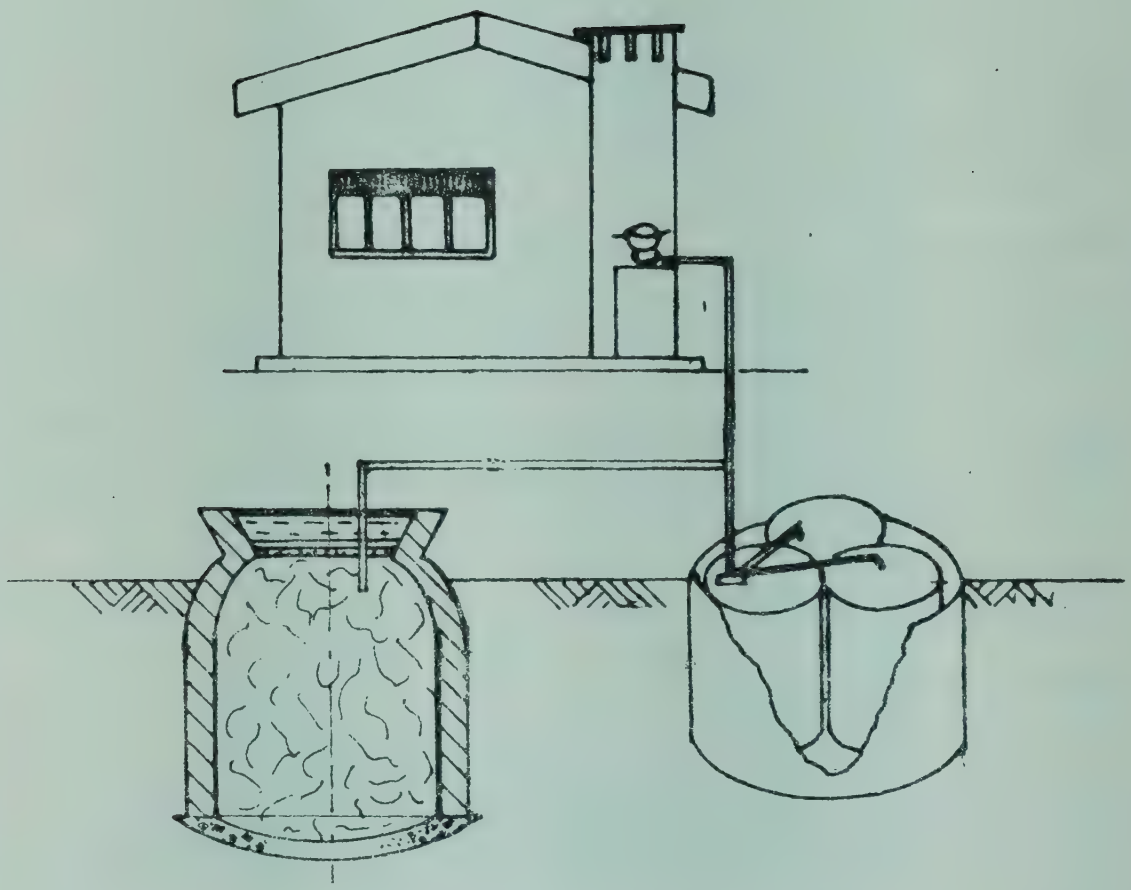
## Project Cost

*Equipment/machinery* : US$ 1,00,000; *Operational cost* : US$ 30,000

## Terms of Transfer

Licensing, joint venture, turnkey

*Contact* : M. VIJAYASARATHY, VIJAY ENERGY PRODUCTS PVT. LTD, SP-75, AMBATTUR INDUSTRIAL ESTATE, MADRAS 600 058, INDIA ☐ TELEPHONE : 645326



BATCH TYPE LANKAN BIOGAS GENERATOR

## BATCH TYPE DRY BIOGAS GENERATOR

### Description

This biogas generator consists of a digester and a gas holder. Gas produced is stored in the holder and it can be used as a fuel for a cooker, for a lamp or can be used to run an engine.

Biogas generator developed by the NERD Centre, uses freely available straw, water hyacinth, salvinia, gliricidia etc as main feeding material. There is no daily or weekly feeding of digester material as in traditional types.

### Advantages

* As the feeding material are straw and other easily available weeds, water hyacinth etc. the operation cost is cheaper and the operation is simpler.
* Charging is done only once in six months
* Water requirement is minimum
* Odourless operation
* No extra labour required for collecting feeding material
* Digested residue is a very good fertilizer and could be used in farming.

### Areas of Application

* As cooking fuel
* Fuels lighting
* To run an engine

### Stage of Development

Ready for commercialisation

### Production Capacity

*Recommended economic scale* : 20 units per month;
*Unit market price* : US$ 150.00 for 1 cu metre of gas per day

### Inputs

*Raw materials* : Bricks, sand, cement, barrels, polythene pipes, joints and other accessories

### Required Space

*Indoor* - 10 sq. metres; *Outdoor* - 15 sq. metres

### Required Manpower

*Skilled* : 3 (2 mason, 1 welder); *Unskilled* : 4

### Project Cost

*Equipment/machinery (FOB)* : US$ 200.00
*Operational cost for one year* : US$ 25,000 per year

### Terms of transfer

Licensing

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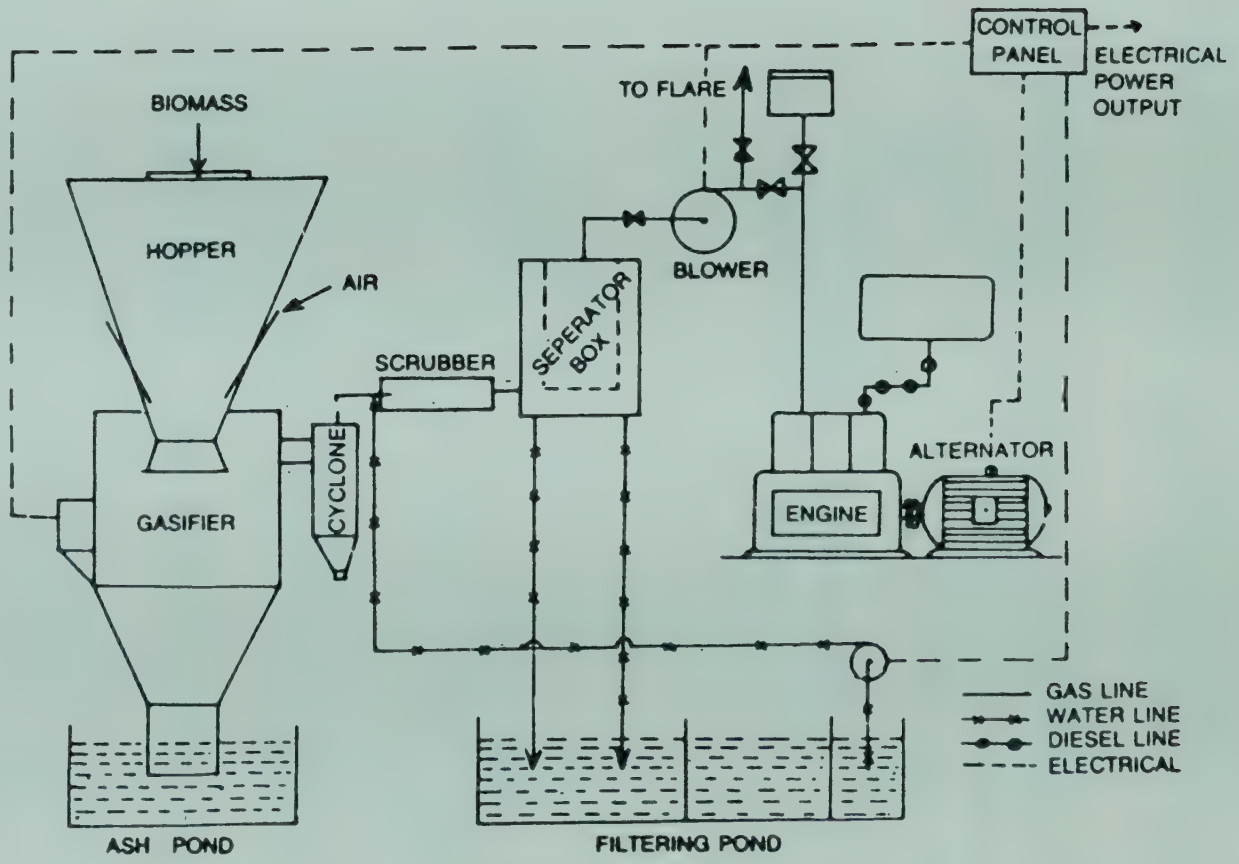
*Contact* : TECHNO ECONOMIC DEPARTMENT. NERDC, INDUSTRIAL ESTATE, EKALA JAELA, SRI LANKA;
☐ TELEPHONE 536434




ELECTRICAL POWER GENERATION

## BIOMASS GASIFICATION SYSTEM

### Description

These gasifiers have power ratings ranging from 3.5 kW to 100 kW or more. The feed stock is woody biomass. The size of the feed stock varies from 10mm to 200mm depending on the specific model. The moisture content of the biomass should not exceed 20% on dry weight basis.

### Advantages

- When used in dual fuel engines, approximately 3.5 kg of biomass saves 1 litre of diesel. Use of spark ignition engines could totally eliminate need for a second fuel (i.e. petrol or diesel) and hence power generation in remote areas could be totally based on biomass.

### Areas of Application

In rural electrification and irrigation water pumping

### Stage of Development

Commercialised in India since 1987

### Production Capacity

100-500 units/year

### Inputs Required

*Raw materials* : Stainless steel; *Land and building* : Indoor - 500 sm; Outdoor - 500 sm; *Manpower* : Skilled - 10; Unskilled - 20

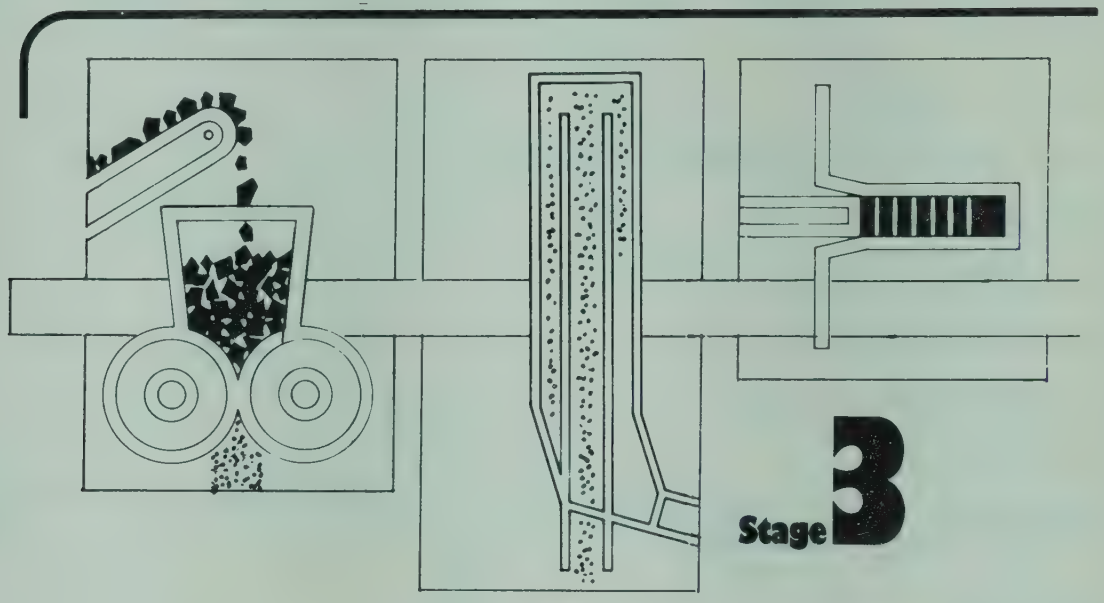
### Project Cost

US$ 80,000 approximately (excluding land/building and labour)

### Terms of Transfer

Licensing

*Contact* : DR B.C. JAIN, PRESIDENT, ANKUR - ENERGY & DEVELOPMENT ALTERNATIVE, 'ANKUR' NEAR OLD SAMA JAKAT NAKA, BARODA 390 008, INDIA



Stage 3

Stage 2

Stage 1

## BRIQUETTING OF AGRICULTURAL WASTES

### Description

This briquetting machine is an extrusion screw type (capacity 2 tons/day) and is equiped with single cylinder of 28.5 cm. length. The power is transmitted from the motor to an extrusion screw by a helical gear, through a pulley system. Three 1 kW heaters are installed at the front end of the cyli der by which the temperature of the cylinder can be controlled to suit various materials.

### Advantages

- Suitable for both domestic and industrial use
- Density is higher than that of firewood. Hence, combustion lasts longer and transportation cost cheaper
- Easily carbonised to obtain good charcoal at a yield of 35-40%
- Reduces problem of firewood shortage and waste disposal

### Applications

The briquettes are utilized as a substitute for fuel wood mostly in rural places. It finds applications both for domestic as well as industrial purposes.

### Stage of Development

Commercialized production in Thailand in 1984

### Production capacity

10 tonnes/day, 5 extruders of 2 tons capacity

### Inputs Required

*Raw materials* : Rice husk, saw dust, bagasse, coconut coir, coffee hull, peanut shell and straw

*Land building* : Indoor - 12 sm; Outdoor - 200 sm

*Manpower* : Skilled - 1; Unskilled - 2

### Terms of Transfer

Sub-contracting

### Project Cost

Equipment & Machinery cost : US$5,000 (unit price) with minium order of 5

Technical know-how/training fee : US$ 500

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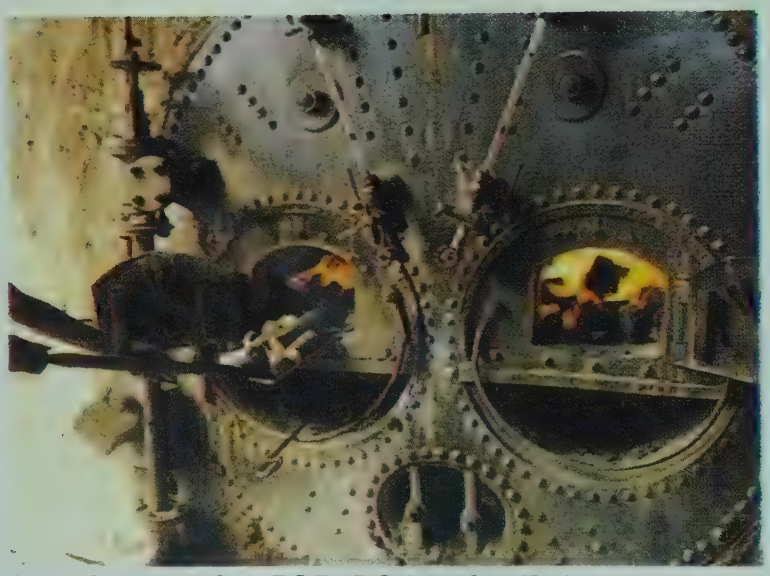
*Contact* : MRS NARA PITAKURNNOP, DIRECTOR, ENERGY TECHNOLOGY DEPARTMENT, THAILAND INSTITUTE OF SCIENTIFIC & TECHNOLOGICAL RESEARCH (TISTR), 196 PHAHONYOTHIN ROAD, BANGKHEN, BANGKOK 10900, THAILAND

SOME COMMON KINDS OF BRIQUETTES



PROVIDING ENERGY FOR BOILERS AT A TEXTILE PLANT

# BRIQUETTING OF BIOLOGICAL WASTES

## Description

Briquetting is a technology where voluminous wastes are densified into a hard, compact product.

## Advantages

Compared with fossil fuels like coal and oil briquettes, this has no air pollution.
Improves acidation and greenhouse effect.
Bogma briquettes are not only of very good quality, but can also be transported, stored and handled without problems.
The briquette, due to it densifying, has a very high energy content/volume.
Economically viable as it is conversion of waste to valuable fuel.

## Areas of Application

Briquetting of biological waste products.

## Stage of Development

Commercialised in Sweden, Cuba, Nicaragua, Finland, etc.

## Inputs Required

*Raw materials* :Almost all kinds of cellulose based wastes, shavings, saw dust, bark, chips, agricultural wastes, etc.

## Terms of Transfer

Licensing

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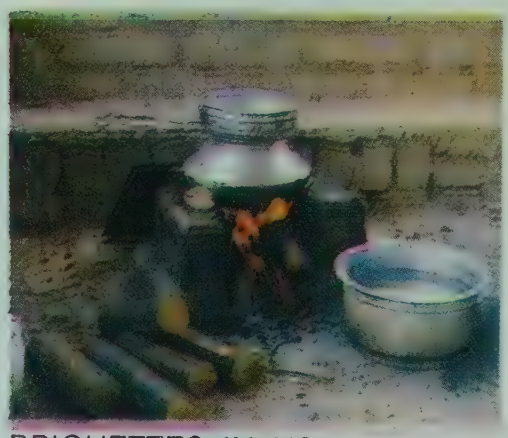
*Contact* : NICLAS WIIK, MANAGING DIRECTOR, BOGMA AB, P.O. BOX 71, S-523 22 ULRICEHAMN, SWEDEN ☐ TELEPHONE : +46 (0) 321-120 10 ☐ FAX : +46 (0) 321-113 40

COLLECTING COTTON STACKS

UNLOADING OF SAW DUST



BRIQUETTES IN USE IN HOME CHULLAHS

## BRIQUETTING OF BIOMASS WASTES

### Description

The plant consists of briquetting press, grinder, dryer, material handling and storage equipments and the process consists of grinding, crushing, drying and binderless briquetting, whereby the material is converted from loose form into higher compact briquettes. Solid fuel briquettes are an ideal substitute for fossil fuels. Agricultural and forest waste such as rice husk, groundnut shells, saw dust, cotton stalks, etc. are converted into Solid Fuel Briquettes.

### Advantages

Have a high calorific value.
Burn evenly and steadily giving a longer lasting fire.
Have low ash content which means no pollution of the environment and longer life for your machinery.
Clean and easy to store.
Saving of cost in disposal or in storage of waste material.

### Areas of Application

Farms, saw mills, paper mills, sugar and textile mills, rice mills, etc.

### Stage of Development

Commercialized in India for the last five years

### Production Capacity

1 metric ton/hr. Range (100 kgs/hr - 3000 kgs/hr & above)

### Inputs Required

*Raw material* : Agricultural and Forest residues
*Utilities* : Water - 300 lts; Power - 82 KW and Fuel - 25 kgs.
*Required Area* : Indoor - 300 sq.m. Outdoor - 2,500 sq.m.
*Manpower* : Skilled - 3, Unskilled - 4

### Project Cost

*Equipment/Machinery* : US$ 78,000;
*Fees for technical knowhow/training* : US$ 11,000;
*Operational cost* : US$ 34,000/year

### Terms of Transfer

Turnkey

*Contact* : HEMANT BHATTER, MANAGING DIRECTOR, M/S. SOLAR SCIENCES CONSULTANCY PVT. LTD., E-39A, EAST OF KAILASH, NEW DELHI 110 065, INDIA ☐ TELEPHONE : 6464916, 6476239 ☐ TELEX : 31-61093 PSPL IN ☐ FAX : (91)011-6463812

EQUIPMENT - HEARTH

## ENERGY FROM MUNICIPAL SOLID WASTE

### Description

Total system for power generation from municipal solid waste. SHENCO process adopts a step by step segregation and elimination of noncombustibles in the garbage and isolate the combustibles. The combustibles are then subjected to size reduction and densification to form compact fuel pellets. The process is flexible enough to accommodate addition of other available waste materials from the agro sector, the industrial sector, the plantation sector etc.

### Advantages

* since the technology includes a sterilisation process, the fuel is hygienic for human handling.

* the fuel burns with smokeless and clean flame. There are no hazardous emissions.

* the fuel has been widely used as an industrial fuel substituting coal in boilers as also in the domestic sector replacing charcoal/kerosene/firewood.

### Stage of Development

* Commercialized in India; patent applied for in India.

### Production Capacity

*Recommended economic scale* : As general purpose fuel - 100 TPD
*Unit market price* : US$ 60/ton.

### Inputs

*Land/building* : for 100 TPD plant
*Indoor* : 20,000 sq.ft
*Outdoor* : 20,000 sq.ft

### Required Manpower

*Skilled* : 15; *Unskilled* : 40

### Project Cost

*Equipment/machinery (FOB)* - Indian Port - US$ 8,00,000;
*Fees for technical know-how/training* : US$ 1,00,000;
*Operational cost for one year* : In India for 100 TPD US$ 1,000,000

### Terms of Transfer

Licensing; Turnkey; Design, Engineering and Consultancy; Supplying of key equipments.

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*Contact* : K.S. SHIVAPRASAD, 170 3RD CROSS, 18TH B MAIN, 6TH BLOCK, KORAMANGALA LAYOUT, BANGALORE 560 034, INDIA, ☐ TELEPHONE: 530361

ROKAR BIOGAS

# ROKAR BIOGAS TECHNOLOGY

## Description

Rokar Biogas Technology is the processing of all kinds of animal and vegetable wastes through an improved multi-purpose biogas apparatus or generator to generate fuel-gas, to simultaneously produce a liquid residue which it considers as a liquid organic fertilizer plus the recovery of solids which could be recycled as an animal feed supplement.

## Advantages

Its ability to generate and produce simultaneously three equally valuable product and byproducts, from wastes of zero value, makes the economic and payback periods very attractive to any financier. Its unique advantage of being possible to mass produce, makes its cost of production low. The improved multi purpose biogas apparatus or generator with Rokar Biogas Technology could be an export potential product

## Areas of Application

All livestock raisers, plants and vegetable plantations and processors, fisherman and any agricultural livehood enterprises cannot operate and lower its cost of production without a reliable and cheap supply sources of fuel-gas for cooking, lighting, heating, drying, running engines to generate electricity, operate irrigation water pumps and to power agricultural farm tractors and vehicles.

By obtaining simultaneously liquid organic fertilizer, much of the fertilizer requirements of the farm in raising much of its feed ingredients is now possible at a lower cost. The cost of the world food supply could now be brought down so that it would be affordable to the poor populations.

The recovery of the solids as an animal feed supplement, high in protein and enhance with vitamin B12 makes our livestock resistant to diseases and effect faster growth. More savings of feed cost is possible to the raisers and feed millers.

## Stage of Development

The improved multi-purpose biogas apparatus or generator with Rokar biogas technology has already three years of commercialization in Philippines in 1982. Much of the livestock industries find it difficult to operate due to the problem of waste disposal and the necessity of being self-sufficient in energy, fertilizer and feed.

## Production capacity

Larger sizes of biogas generators or systems handling no less than 1/2 tons of waste per day involves lower investment and higher rate of return.

## Inputs

*Raw materials*: All kinds of animal and vegetable waste plus dilutions in the form of urine, penwashings and water.
*Utilities*: Part of the fuel-gas generation shall be the fuel to operate and which only takes no more than an hour of each day.
*Land/building*: No building is necessary as the generator must be exposed to Sun light. Land area required is only 1/4 of the old type of concrete biogas generator excluding conditioning lagoons.
*Manpower*: No more than 3 operators.

## Project cost

*Equipment* : For biogas generators the cost would be US$ 300.00 per cubic meter of digester capacity. For biogas systems the cost would be US$ 150.00 per cubic meter of digester capacity; *Operational cost for one year* : The cost of operation per year is only 1/10 of the values of its product and byproducts.

## Terms of Transfer

Turnkey

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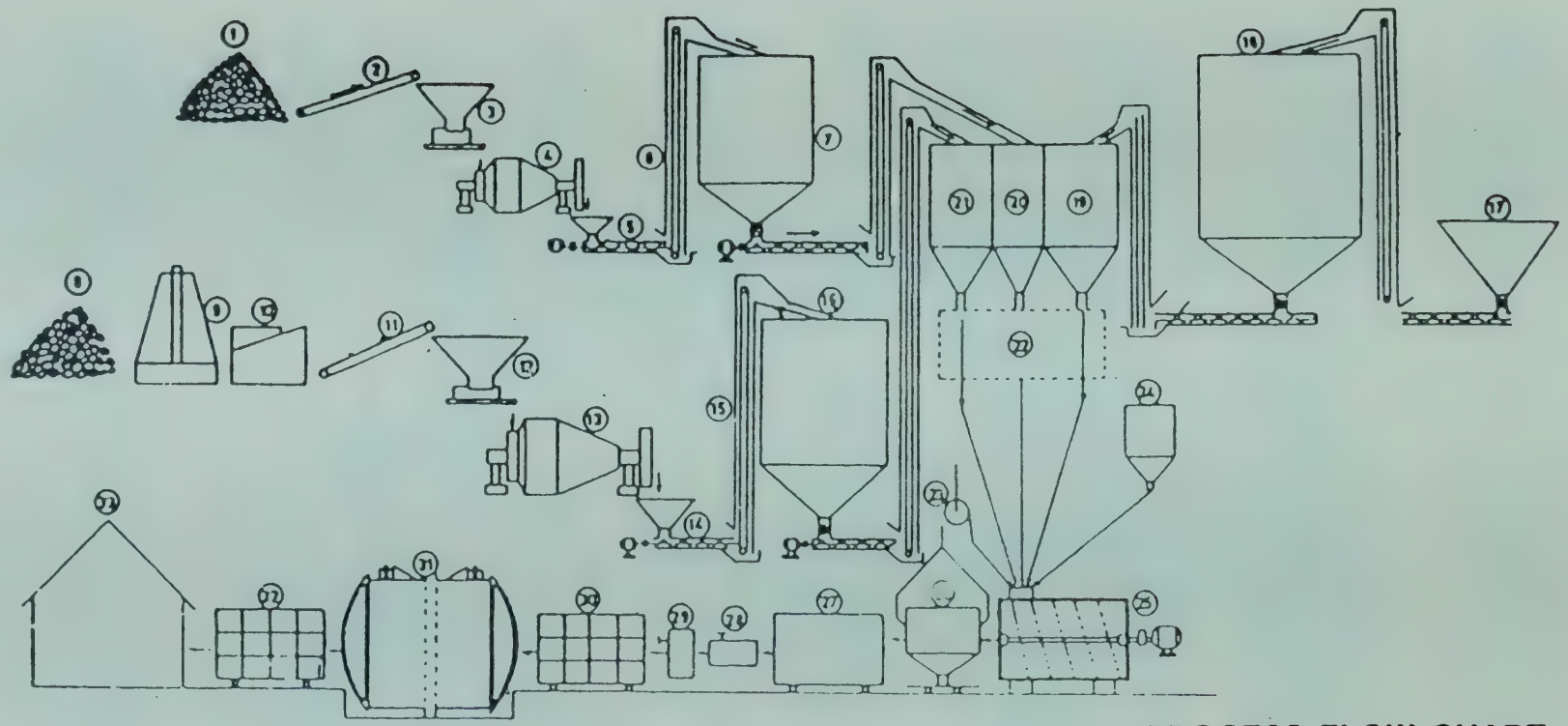
*Contact*: ROKAR METALCRAFT, NO.18 D.REYNADO ST., TIERRA BELLA SUBDIVISION, TANDANG SORA AVENUE QUEZON CITY, PHILIPPINES



## PROCESS FLOW CHART

1 Gypsum storage
2 Belt conveyor for gypsum
3 Rotary table feeder
4 Conical ball mill for grinding of gypsum
5 Screw conveyor for gypsum
6 Bucket elevator
7 Storage silo for gypsum powder
8 Limestone storage
9 Lime kiln
10 Jaw crusher
11 Belt conveyor
12 Rotary table feeder
13 Conical ball mill for griding of lime
14 Screw conveyor
15 Bucket elevator
16 Storage silo for lime powder
17 Hopper for dumping of flyash
18 Storage silo for flyash
19 Silo for flyash
20 Silo for gypsum powder
21 Silo for lime
22 Automatic weighing arrangement
23 Centrifugal pump for water
24 Storage silo for aluminium powder
25 Mixer
26 Trolley for carrying slurry
27 Mould filled with cellular concrete mix
28 Longitudinal cutting machine
29 Transverse cutting machine
30 Moulded component after cutting
31 Autoclave
32 Autoclave component
33 Storage for product component

PROCESS FLOW CHART

# FAL-G BRICK/BLOCK MANUFACTURING TECHNOLOGY

## Description

The process consists of two stages : (i) Preparation of wet Fal-G mix : The flyash, lime and calcined gypsum are charged into a pan mixer with appropriate dosing of water and the mixer is opered for about two minutes. If Fal-G concrete blocks are required, sand and chips may be added in the mix design of 1:2:4 or 1:3:6 depending on strength requirement.(ii) Casting followed by curing : The wet mix is charged to the hopper of moulding machine which has a rotor table with 3 segments of 2 compartments in each. In one segment the material is charged and rotates to the second where the material is nominally compacted and in the third the bricks are ejected. It gives two bricks at six seconds and this pulse rate is adjustable by monitoring the mechanism of hydraulics. The ejected bricks are transferred on to pallets, dried for 24-48 hours under shade and stacked in curing yards for water spray curing once in 4-6 hours for about 3-7 days.

## Advantages

To offset the two deficiencies of the conventional process where crystal formations are feeble and chemistry of hydration is long, it is recommended now to use a heavy duty press and an autoclave by which the flyash based activity becomes less expensive.Fal-G, due to its chemical composition with its innovation to add maximum gypsum commensurating to the reactive alumina of flyash attains cohesive crystal growth, internal compaction and high order of strengths by which both press and autoclave can be avoided, bringing the activity of Fal-G brick manufacture to cottage industry level with a minimal investment towards a stone grinder and a wooden mould to the level of a small scale industry with a modest investment. The production of these bricks is totally energy free either towards sintering or autoclaving.

## Areas of Application

Fal-G bricks, in view of their high order of strengths upto 250-350 $kg/cm^2$, can be used not only for building construction but also for pavements, canal lining, etc.

## Inputs Required

*Raw materials* : Flyash (12.75 tons), lime (3.25 tons), calcined gypsum (1.75 tons), and sand (7.25 tons) [per 10,000 bricks]
*Utilities* : Water - $5m^3$ [per 10,000 bricks]
*Required area* : 1-2 acres

## Stage of Development

Commercialised and about 15 plants are working in India

## Project Cost

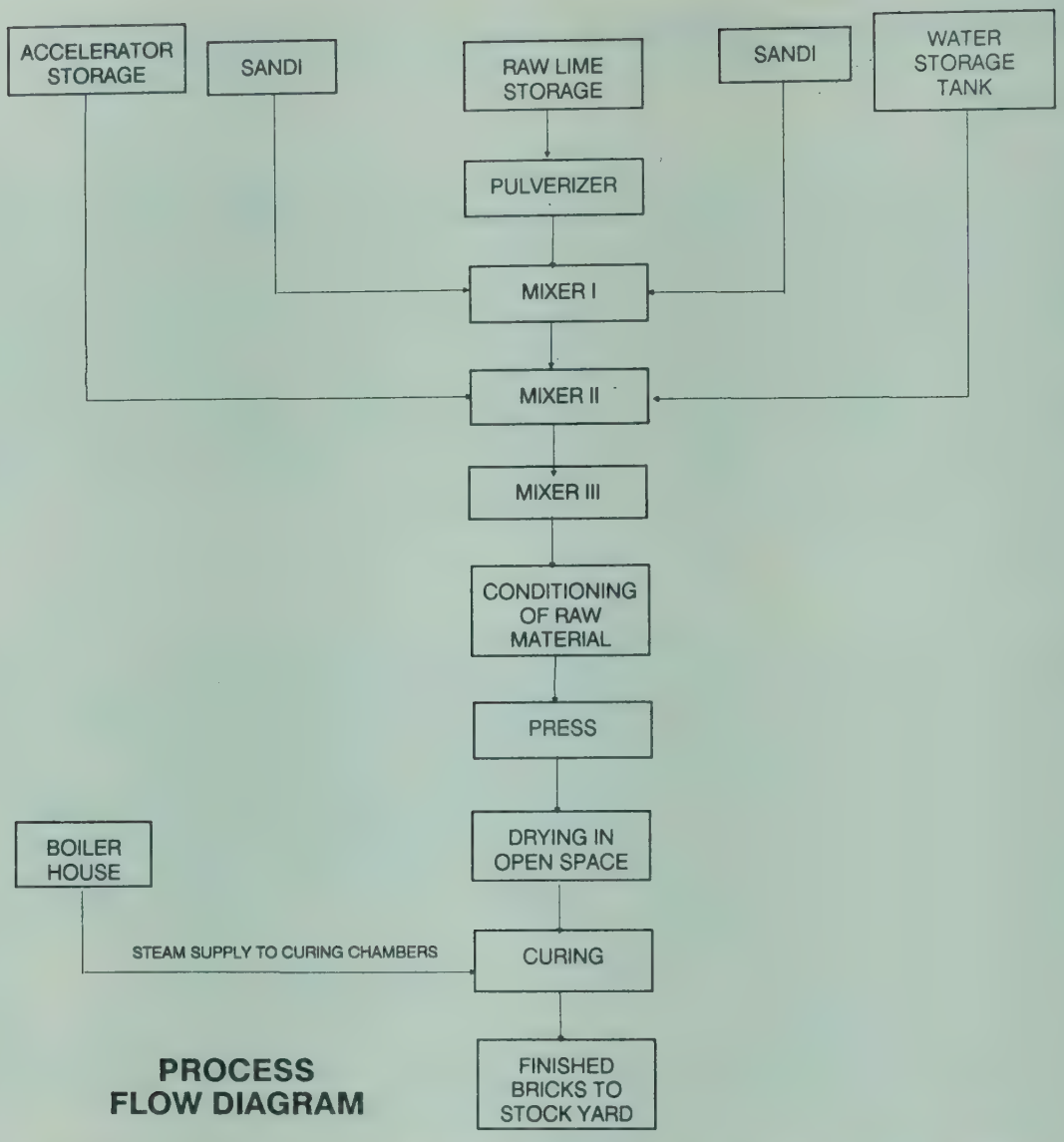
Approx. US$35,000

## Terms of Transfer

Negotiable

---

*Contact* : MR N KALIDAS, CHIEF EXECUTIVE, BHANU INTERNATIONAL, "FAL-G MANSION", 35 SHRI VENKATESWARA COLONY, SHEILANAGAR, VISAKHAPATNAM 530 012, INDIA ☐TELEPHONE : (0891) 56411 ☐TELEX : 0495 - 261 BANU IN




**PROCESS FLOW DIAGRAM**

HYDRAULIC PRESS

# FLY ASH BRICKS

## Description

The process consists of making a mixture of fly ash as such or mixed with some coarse material and lime in the presence of an accelerator with requisite amount of water. This mixture is formed in the shape of bricks in a press and the formed bricks are cured in steam for obtaining definite chemical reaction. The chemically bonded material is the building unit and can be used for construction purposes.

## Advantages

* The strength of the bricks can be adjusted according to user requirements
* Well shaped, cement grey coloured and superior to commonly available burnt clay bricks
* Can withstand saline atmosphere
* Utilize waste from power stations and also reduces pollution to a considerable extent

## Application

In the construction of buildings or any other civil engineering works

## Stage of Development

Patented and commercialized in India in 1986

## Terms of Transfer

Licensing

## Inputs Required

*Raw material* : Fly ash, sand, lime, accelerator
*Land and building* : Indoor - 90x80 sq.m (24,000mm)
*Manpower* : Skilled - 60; Unskilled - 40
*Production capacity* : 25 million bricks/year

## Project Cost

*Equipment and machinery cost* : US$ 0.58 million
*Technical knowhow fee* : US$ 60,000
*Unit market price* : US$ 55 per 1000 bricks of size 250 x 125 x 75 mm
*Operational cost/year* : US$ 1.57 million

*Contact* : NATIONAL RESEARCH DEVELOPMENT CORPORATION (NRDC), 20-22, ZAMROODPUR COMMUNITY CENTRE, KAILASH COLONY EXTENSION, NEW DELHI - 110 048, INDIA

A TEXTILE FACTORY WITH OFFICE AND SALES DEPARTMENT

# FIRE-PROOF CELLULAR PLASTIC-CORE SANDWICH BUILDING ELEMENT

## Description

The cellular plastic-core sandwich element is a new light-weight building unit. The element can be produced using single moulds and practically no degree of automation. All manufacturing and assembly stages can be carried out by using 'handmade' working methods. The production method is suitable for setting up a small scale or a pilot plant in the warm developing countries.

## Advantages

Ecologically clean manufacturing technology and product.
Product fire-resistant, light-weight and modular in construction
Good insulation
Rapid and easy construction
Simple manufacturing method
Low operational cost.

## Areas of Application

In all types of industrial and non-industrial buildings.

## Stage of Development

Patented and commercialized in Finland.

## Production Capacity

100,000 - 150,000 sq.m/year.

## Inputs Required

*Raw Materials* : Polyurethane or Polystyrene, metal sheet, chip board and glue.
*Utilities* : Power - small quantity; water-small quantity; Others-hydraulic press.
*Required Area* : Indoor : 1,000 sq.m. Outdoor : 2,000sq.m.
*Manpower* : Technical - 2-3; Skilled - 3-5; Unskilled - 5-10.

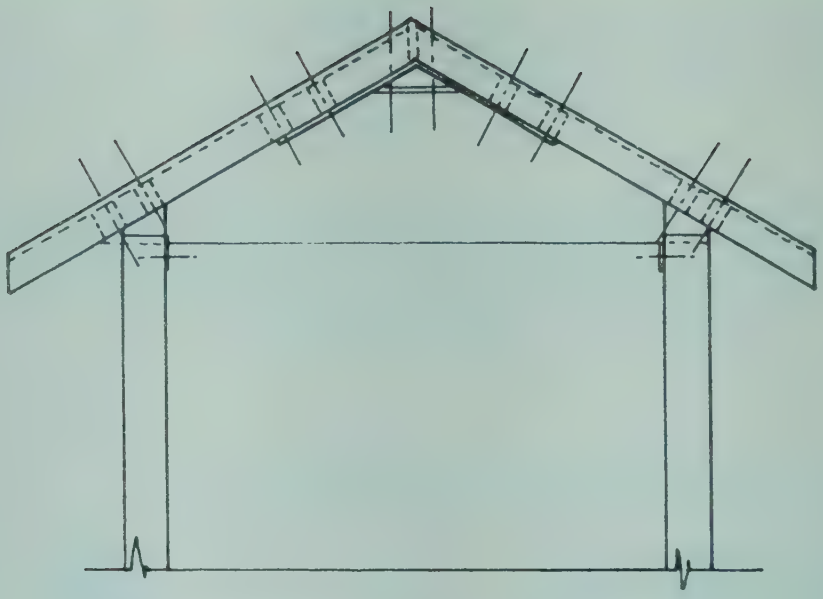
## Project Cost

*Equipment/Machinery* : US$ 250,000-500,000
*Operational cost* : US$ 1-2 million/year

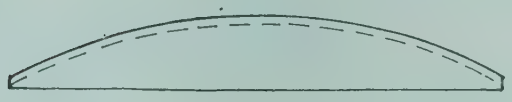
## Terms of Transfer

Licensing, subcontracting, turnkey

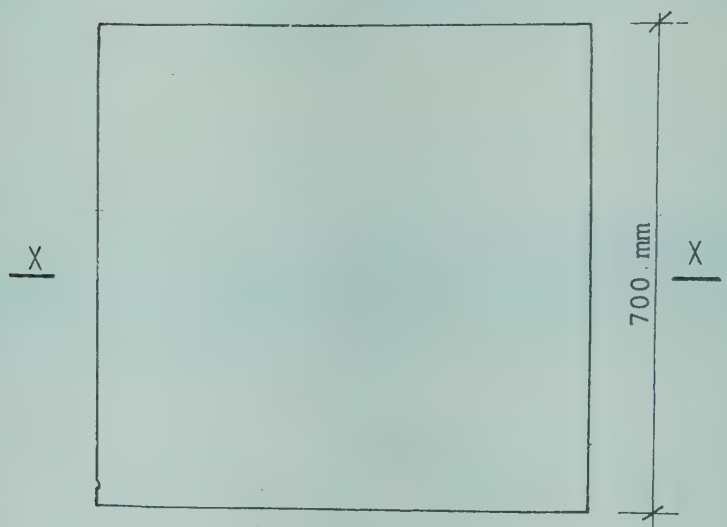
*Contact* : CARL MAGNUS FOGELHOLM, MANAGING DIRECTOR, OY TECH CENTER AB, TEKNLIKANTLE 17C sf-02150, ESPOO, FINLAND ☐ TELEPHONE: 358 0 803 8290 ☐ FAX: 358 0 803 7607

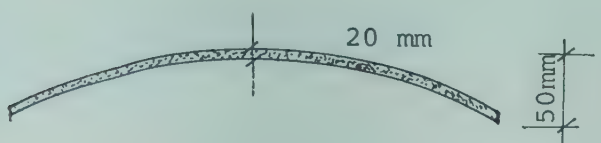


TECHNOLOGY FOR ROOF CONSTRUCTION



ELEVATION




SECTION XX

GEOMETICAL PROPERTIES OF TILES

# LOW COST BUILDING TECHNIQUES

## Description

An effective way to curtail the cost of construction by incorporating novel concepts, specific techniques and cheap materials in the construction of residential houses, public offices and industrial and commercial building. These techniques include frameless roof, slipform walls, concrete door and window frames. A landmark in this field is the development of doubly curved tile which is both economically and technically viable for use in the building.

The novel features of the frameless roof is the complete elimination of wooden timber rafters and purlins. These supporting structures are replaced by small wooden blocks placed at regular intervals on top of the side wall plates and at the roof ridges.

Ideally the roof could be built with asbestos sheets in lengths of 10 to 12 feet placed at an angle of $30^{\circ}$. A 5mm diameter high tensile tie wire is used to anchor the side walls at 10 feet intervals where brick walls are not available.

## Advantages

* Raw materials abundantly available
* very low cost of construction
* reduced construction time
* use of waste materials
* low capital investment and return on investment.

## Stage of Development

Commercialized in Sri Lanka and Indonesia

## Production Capacity

10,000 Sq.M of floor area/year

## Inputs Required

*Land/Building (sq.meters)* : Indoor - 100; Outdoor - 400
*Manpower* (number) : Skilled - 5; Unskilled - 20

## Project Cost

*Equipment/Machinery (FOB)* Pre-cast yard and shuttering etc. : US$ 3000
*Fees for Technical Know-how/Training* : Negotiable

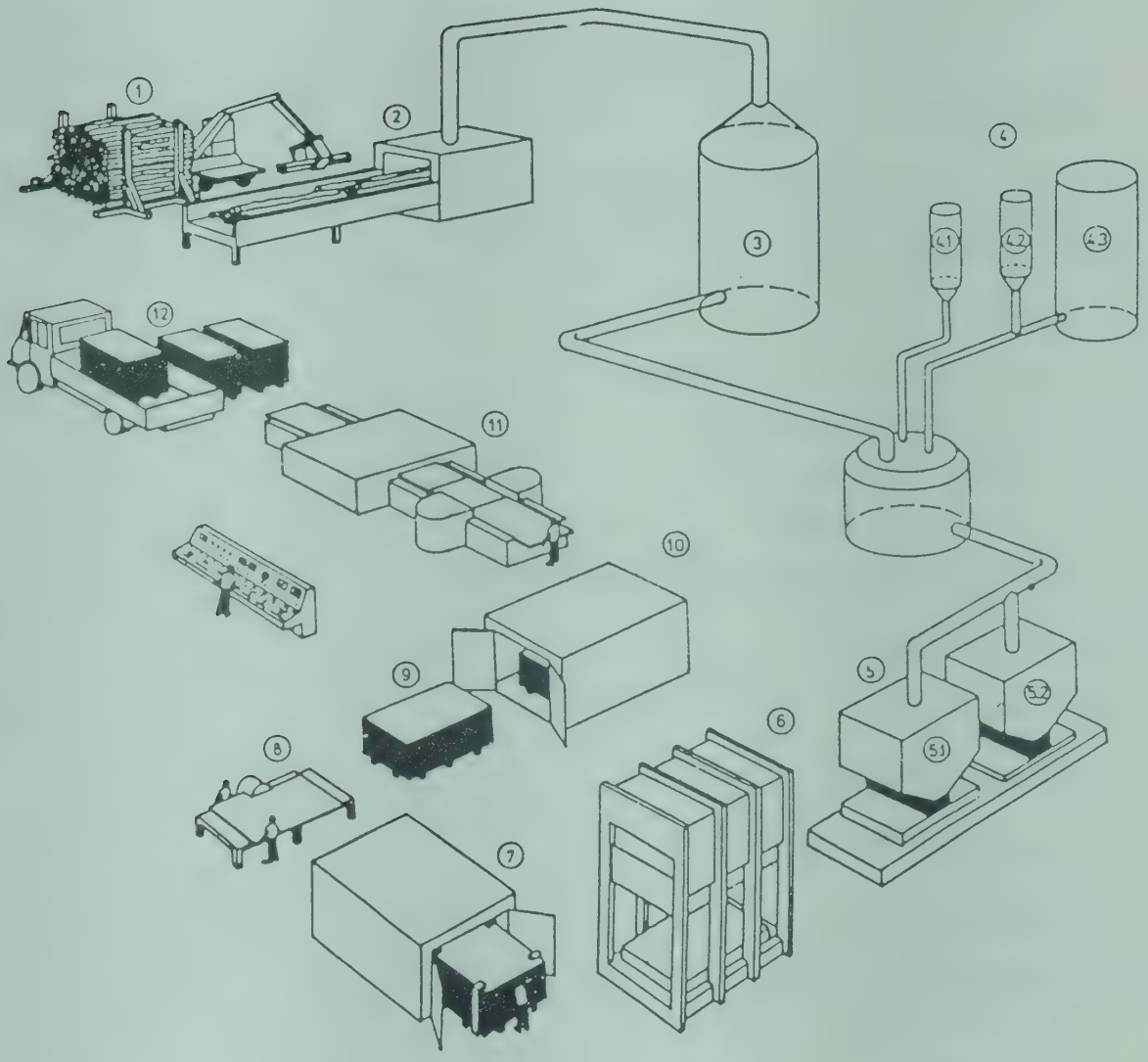
## Terms of Transfer

Licensing

---

*Contact* : CHAIRMAN, NATIONAL ENGINEERING RESEARCH & DEVELOPMENT CENTRE OF SRI LANKA, INDUSTRIAL ESTATE, EKALA, JAELA, SRI LANKA

# *cement bonded particle boards*




1. Wood Store
2. Flaker
3. Sllo
4. Mixing Line
4.1 Chemicals
4.2 Water
4.3 Cement
5. Spreading
6. Press
7. Curing'
8. Pre-Trimming
9 Curing Place
10. Drying
11. Final Control
12. Storage & Shipment

## PARTICLE BOARD - CEMENT BONDED

### Description

Manufacture of Cement Bonded Particle Board from Cement and Timber on an Elten Plant

Duripanel is a Cement Bonded Particle board suitable for exterior and interior use which is asbestos free, contains no hazardous volatiles, its process dust is non-aggressive, and it may be nailed and screwed and sawn, planned, sanded, drilled, routed, with hard tipped woodworking tools and machinery.

Duripanel's main properties are its resistance to fire and rot, its excellent sound attenuation, its workability, its acceptance of a wide variety of finishes and it does not permit the build up on static electric charges.

- **Advantages**
- Durability
- Workability similar to timber products
- Fire resistance
- Moisture resistance
- Resistance to attack by termites, fungus and insects
- Does not contain asbestos, formaldehyde or any other toxic substance
- Low sound transmission properties
- Acceptance of a wide range of surface treatments such as veneers, laminates, high and low technology paints and others.

### Areas of Application

- Walling; Cladding; Flooring; Roofing; Partitions; Fire doors; Shaft and duct linings;Wet room linings; Lining for industrial buildings and warehouses; Backing panels for electrical appliances

### Stage of Development

Commercialized worldwide since 1970.

### Production Capacity

50 cm per 8 hours day/3 shifts; Unit Market price - US$ 800 per cubic meter

### Inputs required

Wood/vegetable fibers; Cement; Contain chemicals; Water; Land/building (sq.m.) Indoor - 4000; Outdoor - 7500; Manpower ( ) ; Skilled - 6; Unskilled-50

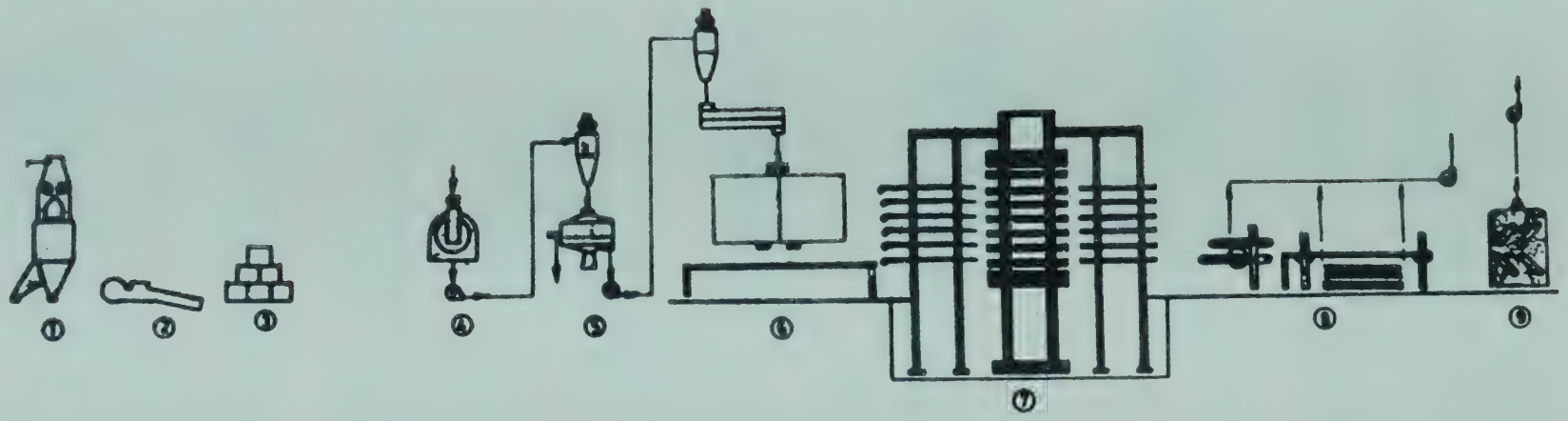
### Project Cost

*Equipment/Machinery* (FOB) US$ 3,000,000; Fees for technical know-how/training US$ 750,000

### Terms of Transfer

Licensing and Turnkey

*Contact* : R.J.H. DIX, INTERNATIONAL SALES EXECUTIVE, ELTEN SYSTEMS, BARON VAN NAGELLSTRAAT 174, 3770 AA BARNEVELD, HOLLAND



**LEGEND**

1) Sugar Mill
2) Depither
3) Baler and Storage
4) Wet Fibre Silo and Dryer
5) Dry Fibre Silo, Refineries and Classification
6) Glue Blending Station
7) Forming and Pressing
8) Trimming and Cooler
9) Sanding

PROCESS FLOW DIAGRAM FOR MANUFACTURE OF PARTICLE BOARD

# PARTICLE BOARDS FROM AGRICULTURAL WASTES

## Description

This is a small-scale, versatile, process plant capable of producing high quality rigid panels from a wide variety of annually renewable crop waste. The fully integrated, PLC controlled process involves the chopping of raw materials and then mixing them with a specially formulated resin binder. The resinated fibres are laid on to metal caul plates and cured in a 1000 tonne steam-heated press. The pressed panels are then trimmed to a standard size of 2.44 mm x 1.22 mm. Panels can be produced in a range of thicknesses from 4 mm to 18 mm.

## Advantages

Waste utilization.
Energy efficient technology.
Process utilizes formaldehyde-free binder.
Small land requirement.
Low investment.
Minimises transport costs.

## Areas of Application

Construction , furniture and packaging industries

## Stage of Development

Commercialised in England. Since 1990, plants have been sold to Norway, Sweden, Pakistan, Sri Lanka and India.

## Production capacity

Around 4500 tonnes per annum.

## Inputs Required

*Raw materials* : Approximately 6000 tons of fibrous agricultural wastes and 150 tonnes of resin binder per annum.
*Utilities* : Power - 85, Water - 500 l/day, Others - GAS (36 GJ) or oil (900 l/day).
*Required Area* : Building - 300 sq.m., plus storage for raw materials and boards.
*Manpower* : Skilled-1, Unskilled-3

## Project Cost

*Equipment/machinery* : US$ 1.6 million.
*Operational cost* : dependent upon local conditions

## Terms of Transfer

Negotiable

*Contact* : NICK MCDONALD, SALES AND MARKETING MANAGER, COMPAK SYSTEMS LIMITED, TORR STREET, GAINSBOROUGH, LINCOLNSHIRE, DN21 2EG, UNITED KINGDOM ☐ TELEPHONE : 44-427-616-927 ☐ TELEX : 56173 COMPAK G ☐ FAX : (0427) 810158

THREE VIEWS OF A PARTICLE BOARD FACTORY

## PARTICLE BOARD PLANT

### Description

This is a low capacity plant combining conventional technology with the latest machinery. The process is economically viable particularly when integrated with existing wood working operations, such as sawmills and plywood mills, or with non-wood based industries such as sugar mills (with bagasse as raw material).

### Advantages

This is a waste utilization technology.
Plant can be integrated with an existing infrastructure or custom-made for available raw materials.
Easy to operate and maintain.
Involves low transportation costs and investment.

### Areas of Application

In construction industry, woodworking and furniture industry and non-wood based industries such as sugar mills, etc.

### Stage of Development

Commercialised in Sweden and many other parts of the world.

### Production Capacity

50-150 cub. m./day.

### Inputs Required

*Raw materials* : UF-resin - 60 kg solid resin/cub. m. board wax emulsion - 5 kg/cub.m. board Hardener - 3 kg/cub.m. board and sawdust/cotton stalks/bagasse/straw
*Utilities* : Electricity - 230 kwh/cub.m.; heating energy - 0.65 Gcal/cub.m.

### Project Cost

*Equipment/machinery* : US$ 4,974 ( 50 cub.m/day model),
US$ 8,198 (150 cub.m/day model)
*Operational cost* :US$ 204 One year (50 cub.m/day model)
US$ 196 One year (150 cub.m/day model)
(including fixed and variable cost)

### Terms of Transfer

Details available on request

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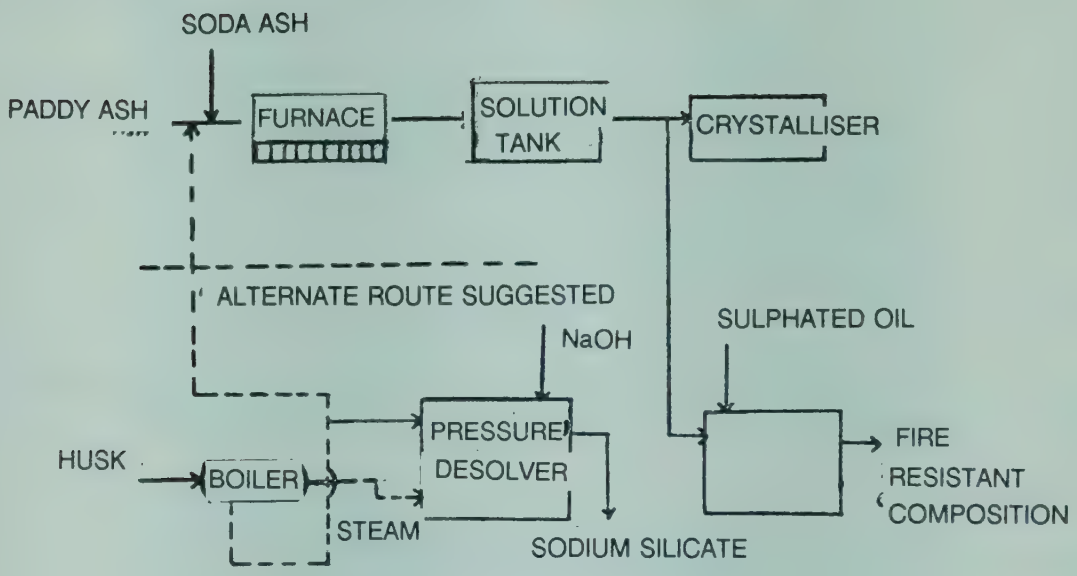
*Contact* : HERLOF DALEN, MANAGING DIRECTOR, M/S. DAPROMA AB, KOLGATAM 7, S-65341 KARLSTAD, SWEDEN




SODIUM SILICATE FROM RICE HUSK FOR FIRE RESISTANT COMPOSITION

# POTASSIUM SILICATE FROM RICE HUSK ASH

## Description

Calicinated Rice husk ash (with minimum Carbon is chemically digested in Caustic Potash/Caustic soda under pressure (Maximum 3 kg/$cm^2$) in different ratios of alkali/silica = upto 1:3.75 depending upon requirement and demand). The time of digestion depends upon the temperature pressure and alkali/acid ratio. The process time depends upon the carbon content in the ash. Alternative source for silica is the waste silica from phosphatic fertilizer plants.

## Advantages

The fine particle size of the rice husk ash (nascent silica)/waste silica (regenerated form/precipitated form) is responsible for quick reaction (low pressure) unlike the high pressures required (6-10 kg/$cm^2$) for the sand/quartz (aged million of years and hence large reaction times).

## Areas of Application

* Electronic
* Welding Rods
* Acid proof cements

## Stage of Development

Patented and commercialised in India

## Production Capacity

5 MT/Day

## Inputs Required

Caustic Potash/Flakes : Gr. I. - 100 Kg/t; Silica - 208 Kg/t; Water - 702 Kg/t
Gr. II - 150 Kg/t; Silica - 260 Kg/t; Water - 590 Kg/t
Purification of R.H. ash/silica requires water twice the weight of silica.
Land/building (sq. meter) Indoor : 150$m^2$; Outdoor: 100$m^2$
Manpower (number) : Skilled - 2; Unskilled - 4

## Project Cost

*Equipment/Machinery* : US$ 10,000
*Fees for Technical Know-how/Training* : US$2000.

## Terms of Transfer

Licensing

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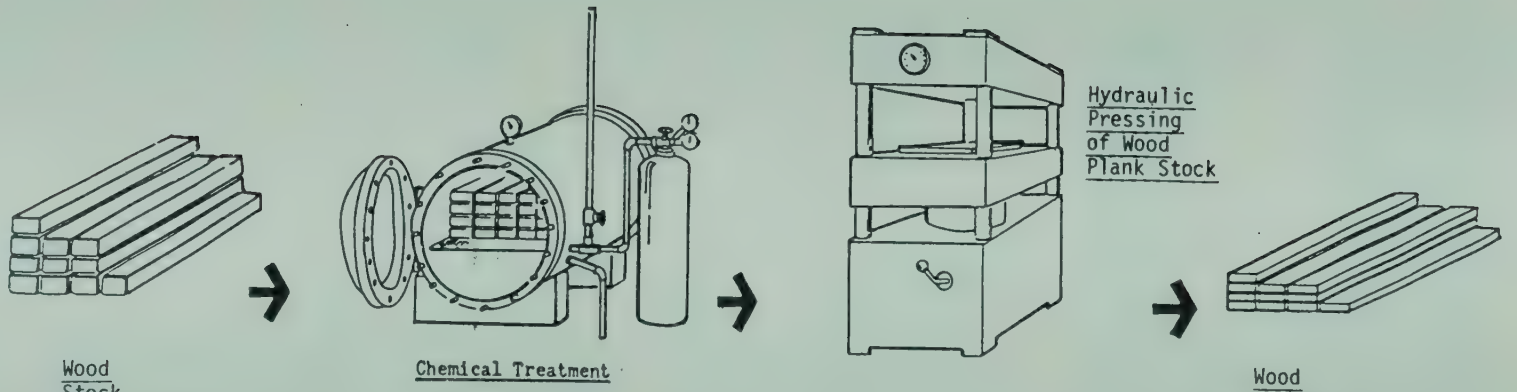
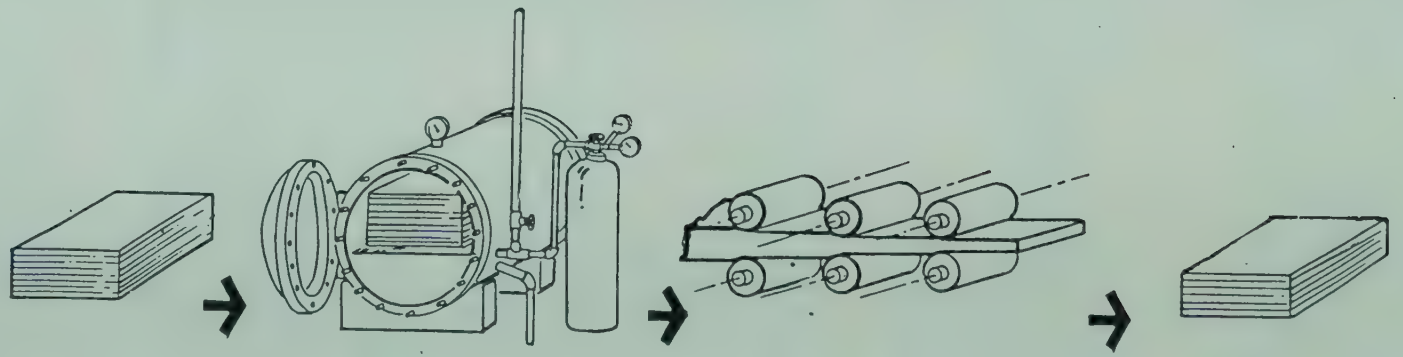
*Contact:* C. SHIVAPRASADA RAO, D-2 SNEHASADAN KARPAGAM AVENUE, 94, SANTHOME HIGH ROAD, MADRAS 600 028,




WOOD PLANKS
WOOD Ddensification PROCESS




VENEERS
WOOD DENSIFICATION PROCESS

# WOOD Ddensification TECHNOLOGY

## Description

Canadian inventor offer licensing of patented technology for all countries, for a mechanical/chemical method to convert low quality, low density woods into high quality, high density hard woods. For example, a low quality poplar wood can be converted into a wood with the same strength characteristics of an oak or birch and the same attractive appearance as a walnut. Also as part of the same process, wood can be bent, formed or deeply embossed, without any additional costs, produce mouldings, curbed furniture pieces and raised relief veneers. Applicable to many species, poplar, alder, oil palm wood, rubber ore wood and others.

## Advantages

Low density woods can be converted into "Manufactured hardwoods, wood increased in strength characteristics, surfaces become more wear resistant, surface increase in hardness, smoothness and ease of finishing and can be produced as wood planks, laminates or as vaneers.

Wood can be coloured throughout thickness which ease of dying wood with bright colours and ease of darkening wood.

Wood can be pressed into shapes and embossing of patterns into wood can be done.

Wood preservation properties of the treated wood leads to killing of bacteria, fungi and other destructive elements to wood.

It is very effective and cheap method so that it can be universally used.

## Areas of Application

The manufactured hardwoods can be applied for any product use where conventional hardwoods are presently used. It is commonly used for the production of veneers, plywoods, furniture, flooring, cabinetry, wood articles and others.

## Stage of Development

US patent approved, also patents applied for in most other countries.

## Inputs :

Raw material - low quality softwood and chemicals

## Terms of Transfer

Licensing and joint venturing in special cases only

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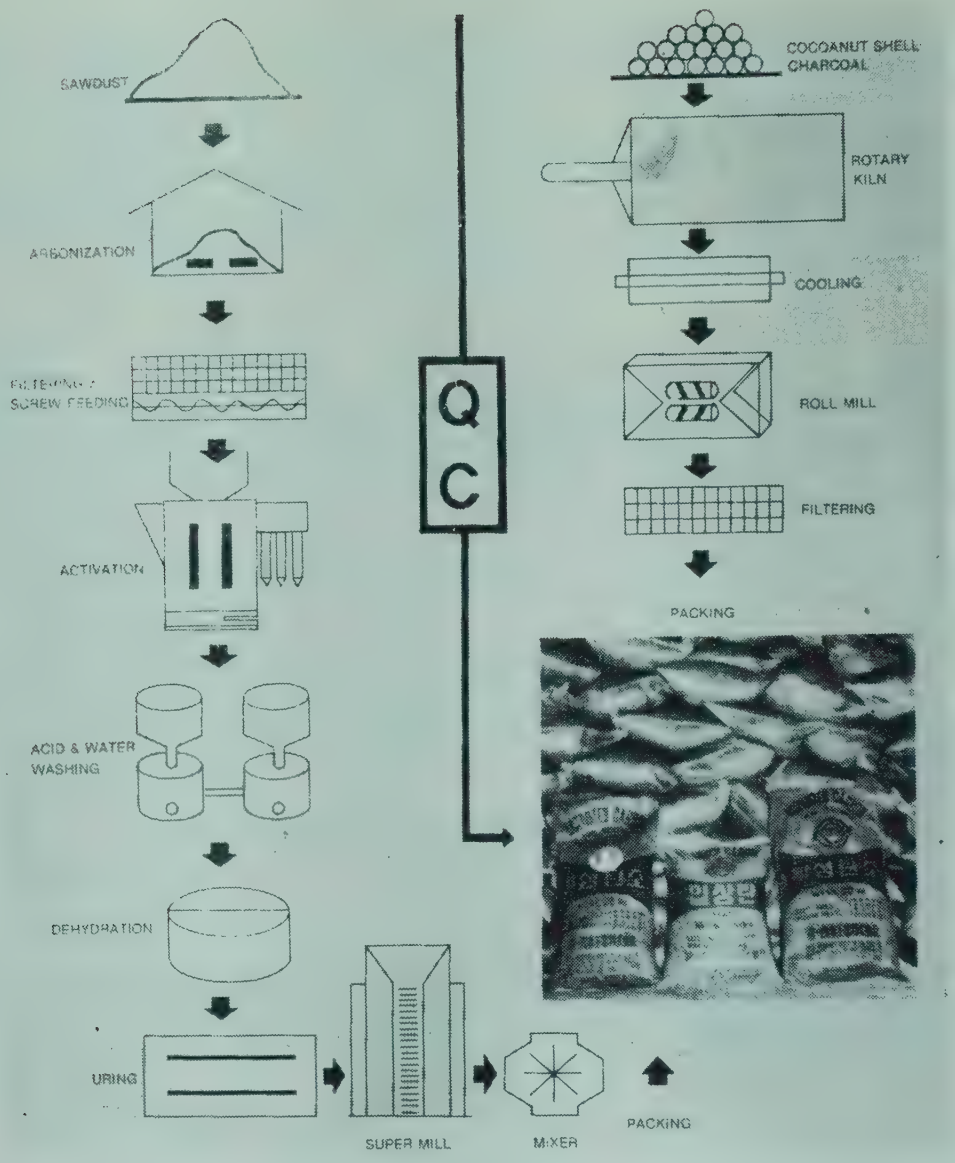
*Contact* : MR. PETER FAVOT, PRESIDENT, RENOVA MANUFACTURING CO. LTD., 170 BOOTH STREET, OTTAWA, ONTARIO, KLR 7W1 CANADA




PROCESS FLOW DIAGRAM

## ACTIVATED CARBON

### Description

The activation of the raw material is accomplished by two basic processes (i) chemical activation and (ii) gas activation depending on starting materials and whether low or high density, powdered or granular carbon is required. This process for the manufacture of activated carbon using saw dust consists of raw material handling, carbonization, screening, activation, cooling, crushing, mixing and packing. The equipments required for this plant are supper mill, cyclone, fan/blower, dust collector, ribbon mixer, conveyor/feeder, packet with roller, bag filter, receiving tank, hopper, vacuum pump, washing tank, compressor and generator

### Advantages

- Any carbonacious materials of plant or mineral origin can be used as raw materials
- Advanced technology

### Application

Activated carbon is used to remove impurities from liquids, gases and to remove valuable substances from gas streams.

### Stage of Development

Commercialised in the Republic of Korea

### Production Capacity

5 metric tons/day

### Inputs Required

Raw materials and utilities : Saw dust - 20 metric tons/day; Electric power : 200 kWh, Phosphoric acid - 40 kg, Cooling water - 5 mt; Land area : 500-2000 sm

### Terms of Transfer

Licensing

---

*Contact* : THE PRESIDENT, HYUNDAI ENGINEERING CO. LTD., HYUNDAI BUILDING 140-2 KYE-DONG, CHONGRO-KU, SEOUL, REPUBLIC OF KOREA

(A) COLLECTION OF MATERIALS

(B) STACKING OF MATERIALS

(C) BULK HANDLING

## ALTERNATIVE PLANT NUTRITION TECHNOLOGY

**Description**

The aim of Alternative Plant Nutrition (A.P.N) Technology is to recycle various, locally emerged wastes for agricultural use, thus replace a considerable part of mineral fertilization with an environment friendly, non-pathogenic, effective humus fertilizer, that is cheap to produce.

Locally emerged organic wastes of various origins/agriculture, horticulture, forestry, fishery, wood, pharmaceutical, meat and other industry, animal manure, animal and municipal sewage sludges/ are bioconverted in humus fertilizers of high biologic value. Bioconversion takes place within 1-3 months by accelerated and directed composting method.

5% of appropriate starter culture/ containing specially selected soil-born microbes/ is required for proper function, if minimal size of the compost pile attains 50 tne. Ready humus fertilizer is directly applicable for plant nutrition. 40-50% moisture content is to be maintained in the pile.

**Advantages**

A considerable part of chemical fertilizers can be economically replaced for cheap, locally occuring organic wastes, which would mean, without recycling, a burden on the environment. Some ecologically hazardous organic wastes can be recycled by directed bioconversion method. The implementation of this technology does not require any additional investment, traditional farm equipment is sufficient. 1 tne. of humus fertilizer replaces 4 tne. of stable manure. 4 tne. of humus fertilizer replace 360 kg pure NPK nutrient content of mineral fertilizer. This technology is appropriate for self-sustainable farming. This technology is suitable for the detoxification of certain dangerous wastes, thus eleminating environmental pollution.

**Stage of Development**

1990 in Hungary and Yugoslavia; 1991 pilot plant experiment in Italy; 1992 introduction of Nigeria is in course.

**Annual Production**

According to available quantity of organic waste.

**Inputs**

a)Raw materials:Most kind of raw materials, which are not contaminated by heavy metals; b)Utilities ; Water : 50%;Others : c/N = 25/1; c)Required area:minimum 100 sqm/200 tne.

**No. of Employee(s)**

Unskilled :1; Tech. Staff :1;

**Operational Costs**

Depending on raw materials sources.

| Product | Packing | Price (in US$) |
|---|---|---|
| Biomass | in 50 ltr. pe bags | 21,50 |
| COFUNA & COFUNA SUPERFIN | in 50 ltr. pe bags | 7,30 |
| COFHUMIN | in 50 ltr. pe bags | 3,60 |
| BIOKOMPLEX-50 | in sack of 40,0 kg | 41,40 |
| ROPSTOP-SB | 1 tne. unpacked | 193,00 |

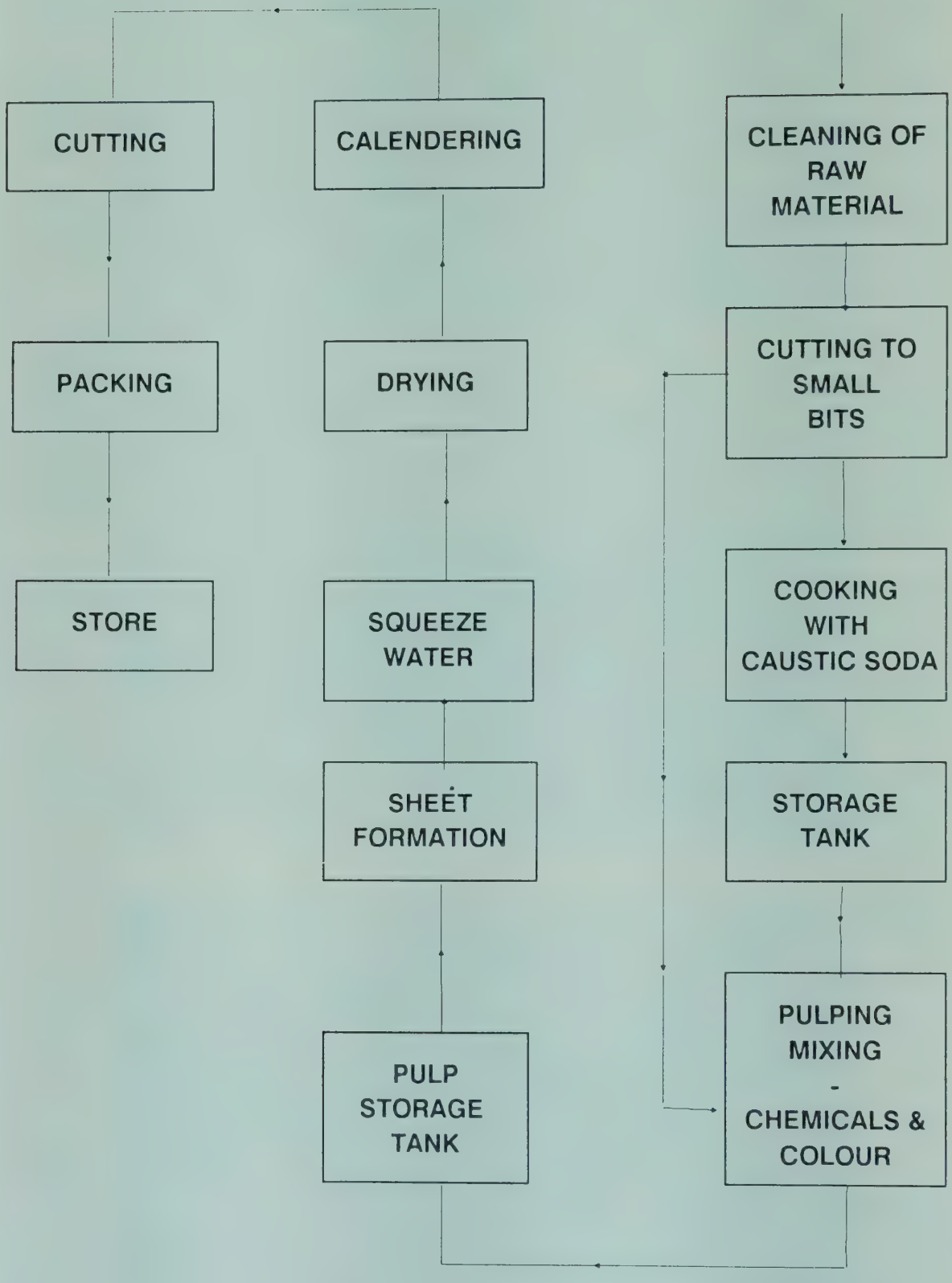
**Ecological/Environmental Aspects:**

a)Clean technology; b)Waste recycling

**Terms of Transfer**

a)Licensing; b)Sub-contracting; c)Joint Venture

*Contact* : MR.GABOR SZELENYI. AGRO-FERM LTD. H-8261 BADACSONY. ROMAI U.2. HUNGARY.
☐ TELEPHONE: 36(87)31-377 ☐ FAX : 36(87)31-094




PROCESS FLOW DIAGRAM

## HAND MADE PAPER

### Description

Hand made paper commonly used for file covers, greeting cards, writing paper, filter paper etc.

### Advantages

The advantage of this technology is that the raw materials consist of waste materials such as waste paper, cotton waste, cotton cloth cuttings, jute waste, straw etc. The technology itself is extremely simple. People can be trained to handle the machines in a period of 2 to 3 months.

### Areas of Application

* File covers
* Greeting cards
* Decorative paper
* Writing paper
* Filter paper
* Insulation board
* Mill board

### Stage of development

There are more than 250 modern Small Scale Hand made Paper units in India producing 25,000 tonnes of paper employing about 10,000 people. In addition there are 7 units working in African continent.

### Production capacity

150 tonnes paper of higher grammage/year or;
250 tonnes paper board/year or;
450 tonnes mill boards/year

### Inputs

*Raw materials* : Waste cotton, Old rags, Cotton tailor cuttings, Waste paper, Waste jute, Hosiery cuttings, Caustic soda, Bleaching powder, Dye-stuffs, Starch, Rosin, Titanium dioxide, Alum Iron-free, Optical bleach
*Utilities* : Electricity: Connected load - 80 kw at 440 V, 3 phase, 50 cycles/sec. AC supply Coal / Fire wood; Process water: 10000 gallons/day
*Land/building* : Total land required is 5000-sq.m; Total building area required is 1024sq.m
*Manpower* : Technical supervisor : 2; Mechanic : 2; Electrician : 2; Skilled workers :17 Unskilled workers : 28

### Project cost

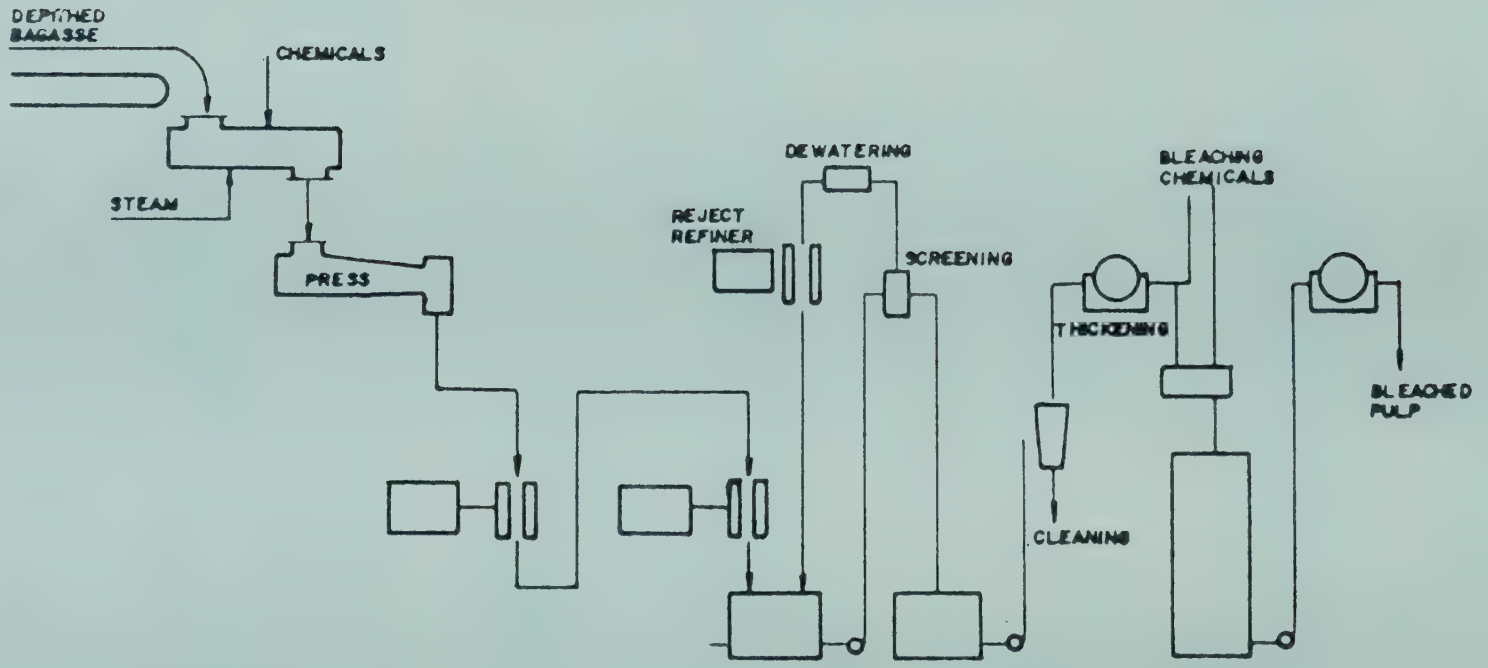
*Equipment/machinery(FOB)* :US$ 75,000

### Terms of Transfer:

Turn-key

---

*Contact*: NATIONAL SMALL INDUSTRIES CORPORATION LIMITED. "LAGHU UDYOG BHAVAN. OKHALA INDUSTRIAL ESTATE. NEW DELHI- 110 020. INDIA.☐ TELEPHONE: 637071 ☐ TELEX: 637071




HIGH YIELD PULP CUBA-9 PROCESS

# HIGH -YIELD BAGASSE PULP

## Description

This is a chemi-mechanical process for production of high yield sugarcane bagasse pulp suitable for non-permanent paper grades. The process involves a mild impregnation, pre-treatment of the clean fibre, followed by two-stage disc refining. In order to produce good quality fibre, whole bagasse is thoroughly depithed at the sugar mill. The pith fraction may be utilized as fuel for the sugar boilers or for other uses, such as cattle-feed mixed with molasses and nutrients, or conditioner for some types of soil. It is preferable that only stored bagasse be consumed by the pulp mill, since shifting to fresh bagasse during the crop season leads to variations in the operating parameters and pulp quality. If bale storage is employed, thorough rewetting of the fibre should be ensured before chemical pre-treatment. Reclaimed bagasse from the storage is pumped at around 3% consistency to a dewatering device wherein the remaining pith and fines are released. The wet, clean fibre is squeezed in a screw press to reduce and homogenize its humidity. The chemical pretreatment is carried out under controlled conditions of temperature, NaOH concentration and lime in a specially designed mixer-impregnator. Treated fibre is dewatered again in a second press and then passes through two-stage disc refining.

## Advantages

The process, because of low bagasse consumption, operating and investment costs and pollution levels, is economically viable in small paper mills, linked to sugar mills of less than 2,500 tons/day crushing capacity.

## Areas of Application

In the manufacture of newsprint, writing and printing paper, corrugating medium and other non-permanent papers.

## Stage of Development

Patented in Cuba, since 1982

## Production Capacity

15,000 tpy pulp

## Inputs Required

*Raw materials* : Whole bagasse, wet, 4 t/ton
*Utilities* : Electricity - 1,100 kWH/ton; Water - 80 m3/ton; Fuel - 0.2 t/ton
*Required Area* : Indoor - 2,500 sq.m. Outdoor -6,000 mt.
*Manpower* : Skilled - 100; Unskilled - 60

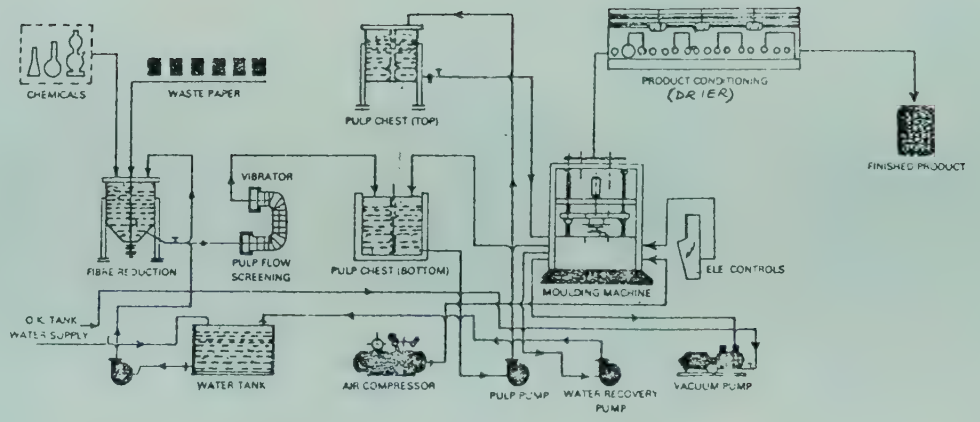
## Project Cost

*Equipment/Machinery* : US$ 7,000,000
*Operational cost* : US$ 2,200,000/year.

## Terms of Transfer

Licensing, sub-contracting

*Contact* : NANCY FERNANDEZ RODRIGUEZ OR OSCAR L GARCIA, CUBA 9 RESEARCH CENTRE, POST BOX 8, QUIVICAN, HAVANA, CUBA, ☐ TELEX : TEAZU 51-1022




PRODUCTION -PROCESSES

## PAPER PULP MOULDING PLANTS

### Description

This is a cylinder type machine. The machine is rugged and meant for continuous 3-shift operations. Custom designed models are also available.

### Advantages

* Offers a wide range of models at the best cost economic benefits

* Can produce variety of products and further finishing technique such as flocking can be incorporated.

### Areas of Application

Egg trays, apple trays, fruit pack trays and many other pulp moulded packaging products

### Stage of Development

Commercialized in India since 1983

### Production capacity

800-3200 egg trays per hour

### Inputs

*Raw materials* : Mainly waste paper

### Project Cost

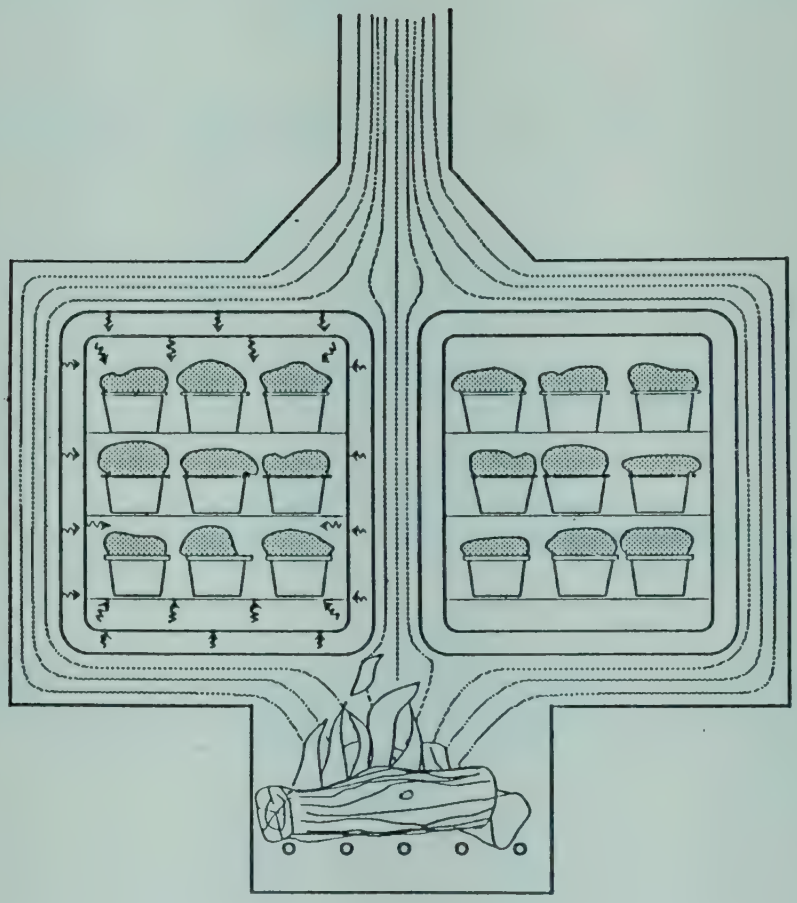
*Equipment/machinery (FOB) India* : Ranging from US$ 70,000 to US$ 350,000
*Fees for technical know-how* : supplied without extra cost along with plant and machinery
*Operational cost for one year* : Range from US$ 120,000 - US$ 500,000

### Terms of Transfer

Turnkey; Plant and machinery supply

---

*Contact* : T.K.S. VARMA, GENERAL MANAGER (MARKETING), MECHANICAL ASSEMBLY SYSTEMS (INDIA) PRIVATE LIMITED, B-3, GEMS COURT, II FLOOR, 14 KHADER NAWAZ KHAN ROAD, NUNGAMBAKKAM, MADRAS 600 006



EFFICIENT AND FAST BIOMASS FUELED BAKING OVENS

## BREAD OVENS

### Description

Wood, Charcoal, gas and oil fired bread oven can produce 1,000 loaves of 1/4 kg a day with very low fuel consumption. Oven is made either with stainless steel or steel. High quality insulation (KAO-Wool) refractories ensures a lifetime of 20 years and has a high quality oven thermometer.

The Bread Oven has three distinct components.

1) A well insulated fine box that has grate and primary and secondary control

2) Two baking chambers

3) Series of passageways that separate the baking chambers from the outer insulated walls.

### Advantages

- - Fast start up (10-20 mts)
- - Portable
- - Fuel efficieny
- - Hygienic and easy to clean
- - Controllable and smokeless
- - Good distribution of heat
- - Also bakes cakes and biscuits

### Areas of Application

Small bakeries in urban and rural areas

### Stage of Development

Commercialised in Australia

### Production Capacity :

A$ 4,000/- for 1000 1/4 kg loaves per day

A$ 3,000/- for 600 1/4 kg loaves per day.

### Project Cost :

Technology transfer A$-30,000/- includes full set of plans and training.

### Terms of Transfer

Licensing

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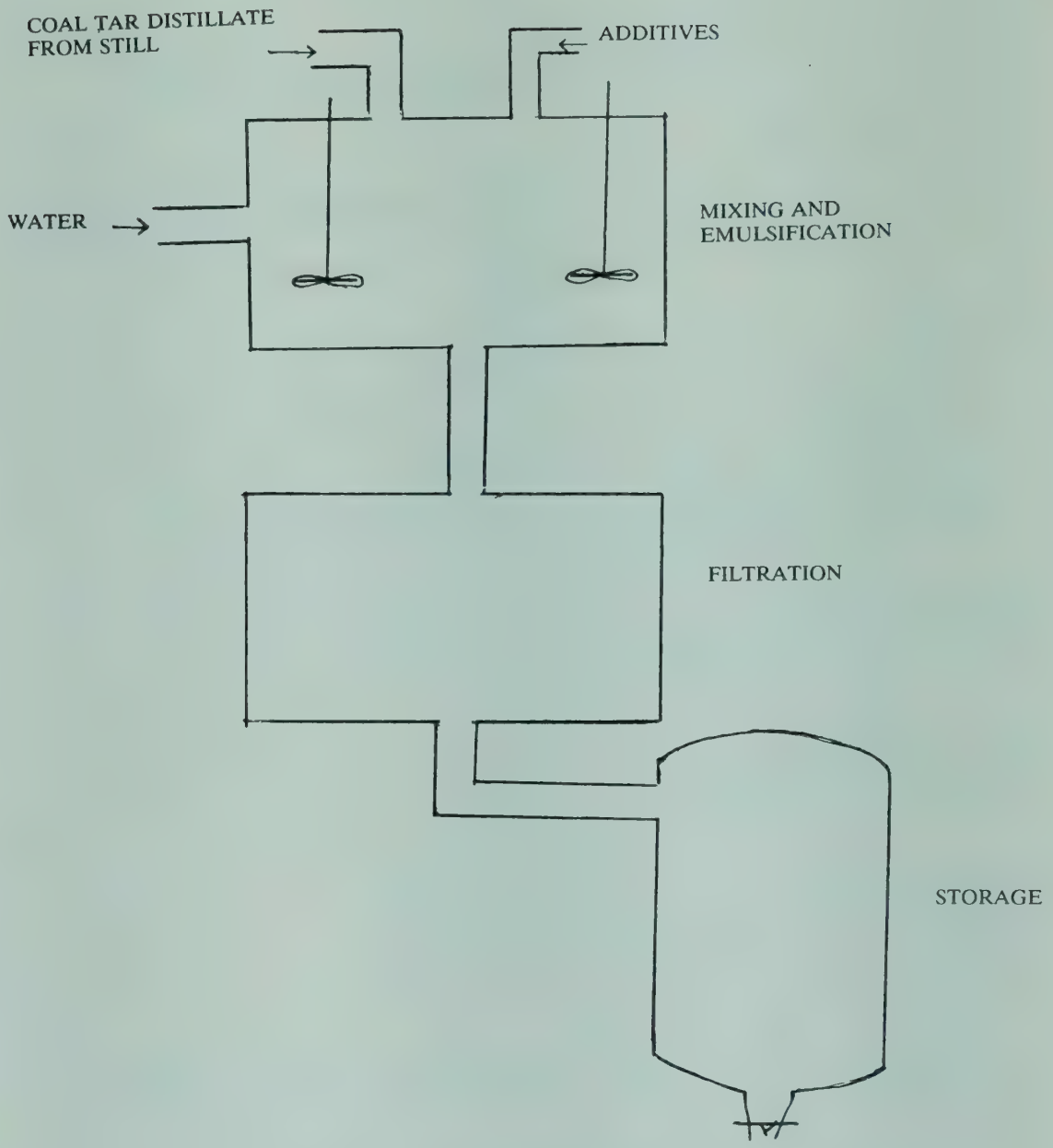
*Contact* : DR. STEPHEN JOSEPH, NO. 5, KENNETH AVE, SORATOGA NSW 2250, AUSTRALIA




A PROCESS FLOW DIAGRAM

## CLEAN GASOLINE

### Description

The process involves mixing of coal tar distillate with water, emulsifying agents and additives through emulsification, agitation and filtration to produce clean gasoline. *Technical specifications:* Octane Number - 700; Sulphur Contents - 0.15%.

### Advantages

Has less carbon accumulation.
Less polluting compared to ordinary gasoline.
Low investment.
Simple process.
Burning efficiency is better than that of ordinary gasoline.
Economically viable.

### Areas of Application

Suitable for all kinds of gasoline engines, vehicles.

### Stage of Development

Pilot Plant

### Inputs Required

*Raw Materials* : 13,000 tons coal tar [for 10,000 tons capacity]
*Utilities* : Power - 2,000 kWh/annum; Water - 5,000 tons/annum
*Required Area* : Indoor - 2,400 sq.m.; Outdoor - 6,000 sq.m.
Manpower : Skilled 45; Unskilled - 25

### Project Cost

*Equipment/Machinery* : US$ 200,000
*Operational Cost* : US$ 18,000/year

### Terms of Transfer

Investment, Joint venture

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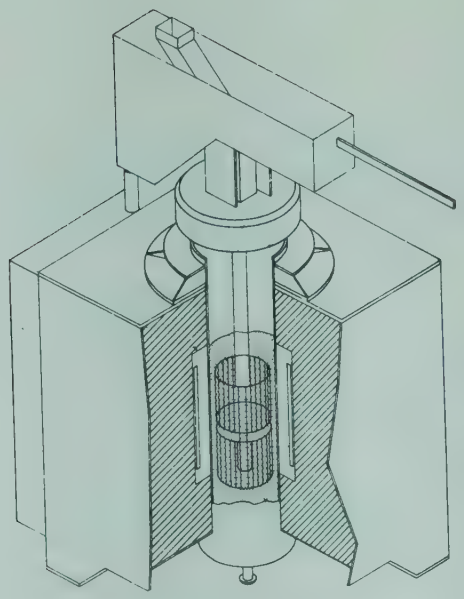
*Contact* : PRESIDENT, SHENYANG CHUNSHAN NEW ENERGY CO. LTD., 61 NANTA STREET, DONGLING DISTRICT, SHENYANG 110015, CHINA (P.R)



CROSS SECTION OF AN ELECTRIC FLUIDISED BED FURNACE

A VIEW OF THE INSTALLATION

## FLUIDISED BED HEAT TREATING EQUIPMENT

### Description

The process includes metallurgical heat treatment facilities for in-house or job work needs. The main component is the fluidised bed furnace which is a non polluting energy efficient alternative to conventional furnaces. Auxiliary equipment comprise quench tanks, washers, material handling, other infrastructurals, testing and laboratory equipment.

### Advantages

This earth friendly technology eliminates toxic salt bath furnaces.
Energy efficient and the operating cost is lower than in conventional furnaces. Additional furnaces can be dispensed as this single furnace performs all heat treatment processes.

### Areas of Application

Heat treatment processes like carburising, nitriding, hardening on various automobile parts, machine tool components, dies and moulds.

### Stage of Development

Complete processing know-how as well as metallurgical back up are offered. Lab size to large scale production plants are available.

Commercialised

### Inputs Required

*Raw materials* : Mild steel, refractory, alloy steel, instruments and switch gear
*Utilities* : Power - 50 to 250 kW
*Required area* : Indoor 40-600$m^2$
*Other inputs* : Technical training for manpower

### Terms of Transfer

Licensing, Joint venture, Turnkey

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Contact : MR. N.GOPINATH, MANAGING DIRECTOR, FLUIDTHERM TECHNOLOGY LTD., S.P. 132, IIIRD MAIN ROAD, AMBATTUR INDUSTRIAL ESTATE, MADRAS 600 058, INDIA ☐ TELEPHONE : (044) 656789, 656264 ☐ TELEX : 041-22068 FTLM IN ☐ FAX : 91-44-6257632

FRONT VIEW OF THE MACHINE

## FRYING MACHINE

### Description

This machine is a semi automatic machine. It consists of three main parts : extrusion; frying and collection. The extrusion and collection parts are operated by a pneumatic system. 1 HP air compressor is used to run the pneumatic system. Liquified Petroleum Gas (LPG) is used to heat the cooking oil for frying the muruku. Overall the machine measures 2850mm (L) x 1060mm (W) x 1850 (H) and weigha 200 kg weight (approx.)

### Advantages

The machine could help the muruku manufacturer to produce a large volume of muruku with lower labour costs and less time consuming compared to the manual method being used at present.

The machine could also be used for frying other snack food like keropok, potato chip, etc. For this purpose the extrusion part is not needed.

### Areas of Application

Small scale snack food industry

### Stage of Development

The machine is still under prototype stages. So far two prototypes had been developed. 1st prototype in 1984 and 2nd prototype in 1985.

### Production Capacity

30 kg/hr (approx.)

### Inputs Required

*Raw materials* : Muruku dough, cooking oil (15 gallons approx.)
*Utilities* : Electricity and Liquified Petroleum gas (LPG)
*Land/Building* (Sq. mtrs) : Indoor - 15
*Manpower* (number) : Unskilled - 2

### Terms of Transfer

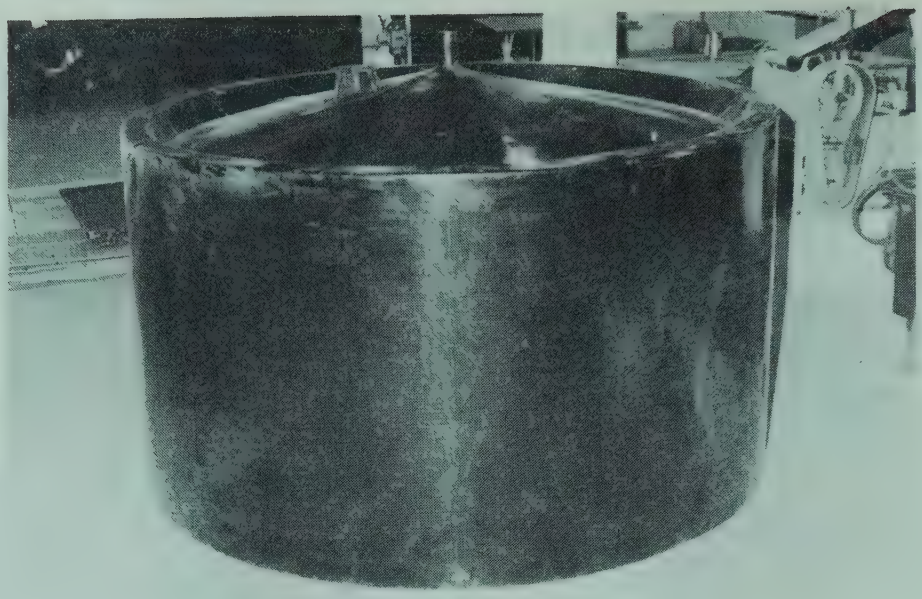
Research and Development

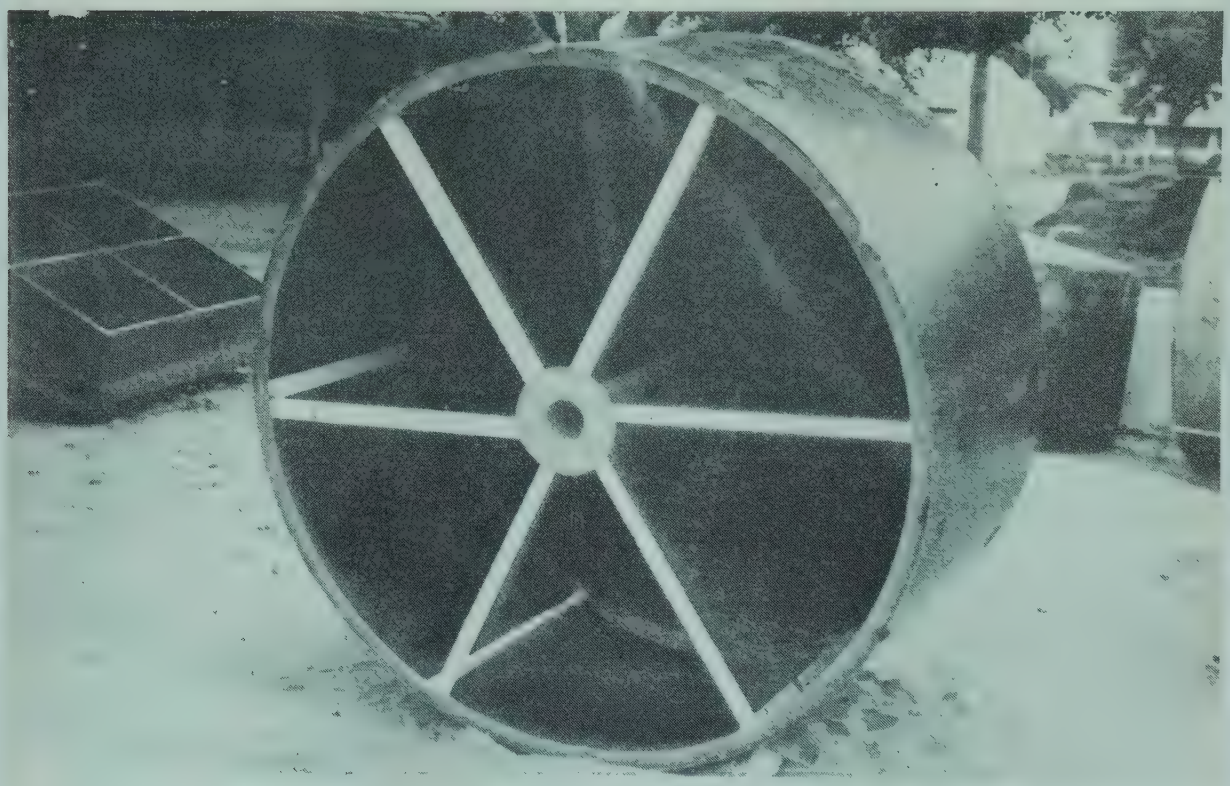
### Project Cost

*Equipment/Machinery (FOB)* : M$ 6000 (approx.)
*Operational cost* : Electricity - M$ 300 (approx.); LPG - M$ 1500 (approx.). Based on 300 working days at 8 hours/day.

---

*Contact* : MR. WOO SENG KEE, STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM), LOT 10810, PERINGKAT 3, LEBUHRAYA PERSEKUTUAN, P.O. BOX 35, 40700 SHAH ALAM, SELANGOR ☐ TELEPHONE : 03-5592601, 5591630 ☐ TELEX : SIRIM MA 38672 ☐ CABLE : SIRIMSEC SHAH ALAM ☐ FAX: 603-5508095





TWO VIEWS OF BIOGAS HOLDERS

## GRP BIOGAS HOLDERS

### Description

This is basically a floating dome that moves up and down (depending on the pressure) in a cement digester containing crater-dung slurry. The holder gets filled with methane and other volatile gases produced during anaerobic digestion of biomass. The biogas plant normally serves individuals/communities in rural areas for meeting the needs of heating/working and lighting. The GRP biogas holder is available in various capacities in the range of 2,3,4,6,8 and $10M^3$. The fabrication is by contact moulding (hand-lay-up) technique involving use of glas fibre reinforcement, thermosetting unsaturated polyester resin and other related chemical accessories. The feature of the design is that the entire gas holder (including structural sections and central pipe) is made in GRP.

### Advantages

- Light weight (50-70%) lighter than carbon steel
- Minimum maintenance
- Longer life
- High strength and design flexibility
- Resistance to temperature changes

### Areas of Application

The holder can be used especially in rural areas where dung/excretion is available as biowaste to generate biogas. The generated biogas is used in lighting cooking and the leftover sludge is used as a manure in agriculture.

### Stage of Development

Patented in India in 1989.

### Raw materials :

Glass fibre reinforcement (Roving, Woven Roving, Chopped Strang Mat), Unsaturated Isophthalic Polyester Resin, Accelerator, Catalyst, Pigments.

Area Required : Indoor 6000 $M^2$

### Terms of Transfer :

Available on request. The technology transfer package, will cover fabrication details, raw material specifications, fitment/assembly quality control, method of repair, bill of materials, manpower requirement, as well as literature/drawings covering basic design aspects. All these details will be incorporated in the form of a manual.

*Contact* : S. SUNDARAM, SENIOR MANAGER R&D, GLASSFIBRE TECHNOLOGY CENTRE, CEAT LIMITED, PLOT NO. 4 AND 5, RASOOLPURAM, CANTONMENT, SECUNDERABAD 500 003, INDIA

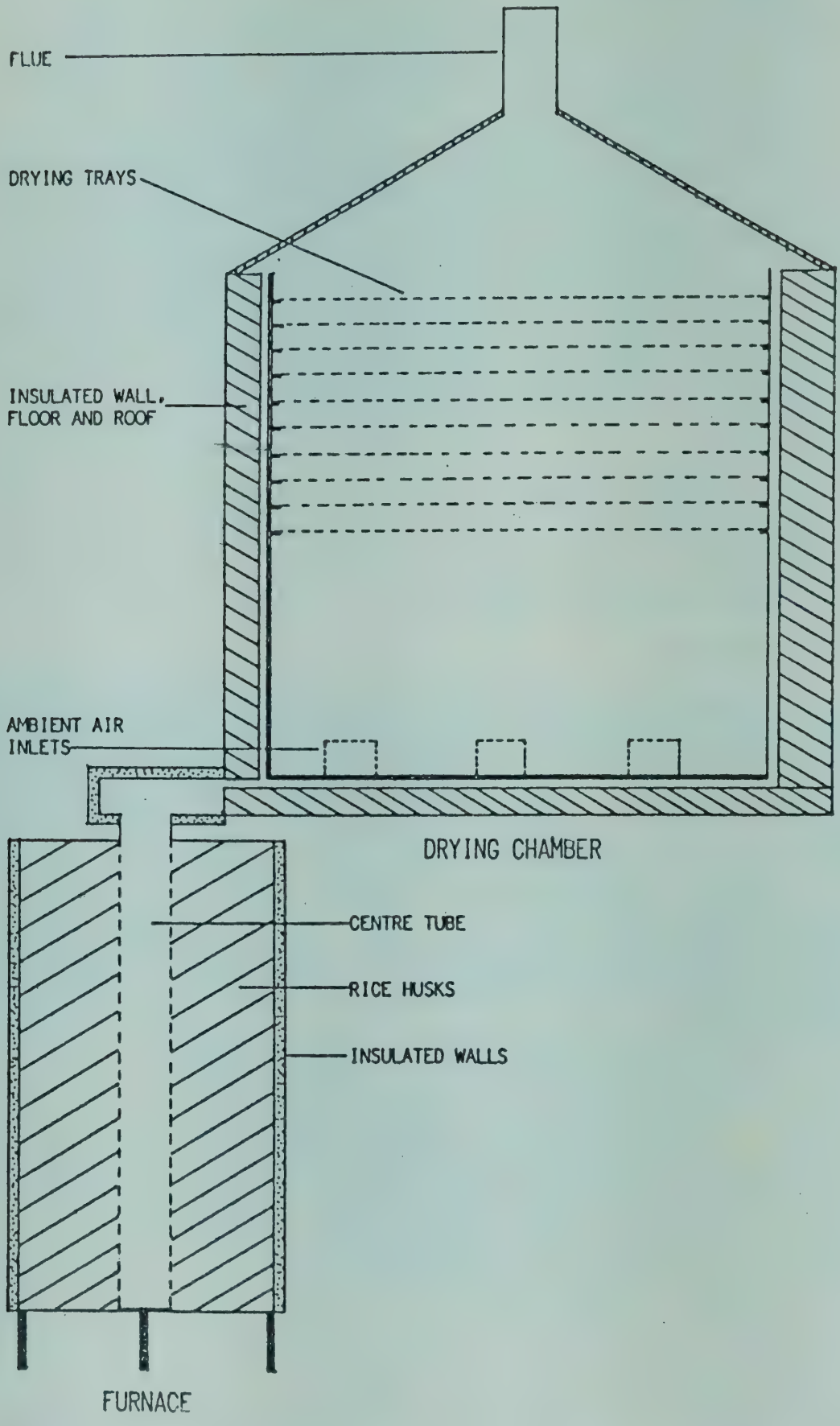



DIAGRAM OF RICE HUSK FURNACE AND FISH DRYING CABINET CONSTRUCTED AT GOSFORD, N.S.W.

# LOW-COST RESIDUE-FUELLED FOOD DRYER

## Description

The dryer consists of a furnace that can use rice husk or sawdust or wood or coconut shells, etc. as fuel, and a dryer that contains an air heat exchanger and the trays to hold the produce. The furnace can be operated continuously for up to eight hours; has a maximum output of 20kw and an average flue gas temperature of 800°C. The dryer is constructed mainly from mud blocks and the roof is made from corrugated iron. The outer walls are made from a mixture of rice husk ash mud and a little cement. The inner walls are made from sheet steel. The produce is placed on a series of trays. The dryer uses indirect heat to dry and the stack gases are used to draw the air into the drying cabinet.

## Areas of Application

To dry fish, vegetables and other agricultural produce.

## Stage of Development

Pilot plant

## Production Capacity

100-500 kg. fish/day

## Inputs Required

*Utilities* : Fuel - 20 kg rice husk/hour.
*Required Area* : Indoor - 6 m. sq.
*Manpower* : Skilled - 1

## Project Cost

*Fees for technical know-how/training* : US$ 30,000

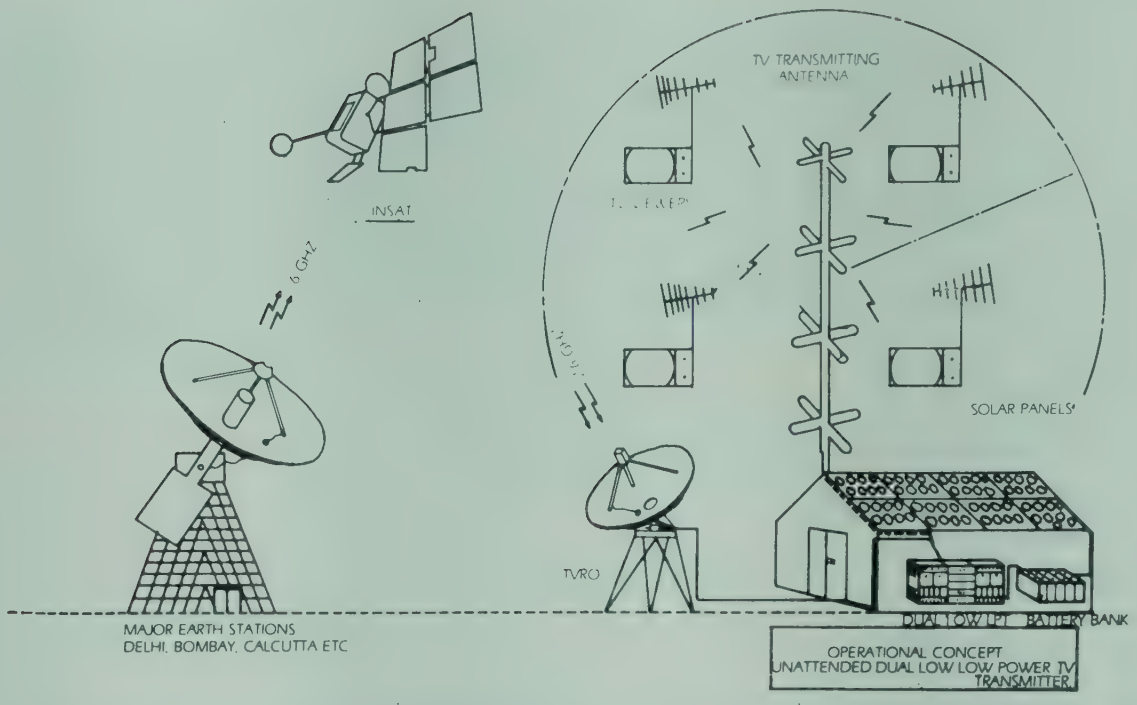
## Terms of Transfer

Negotiable

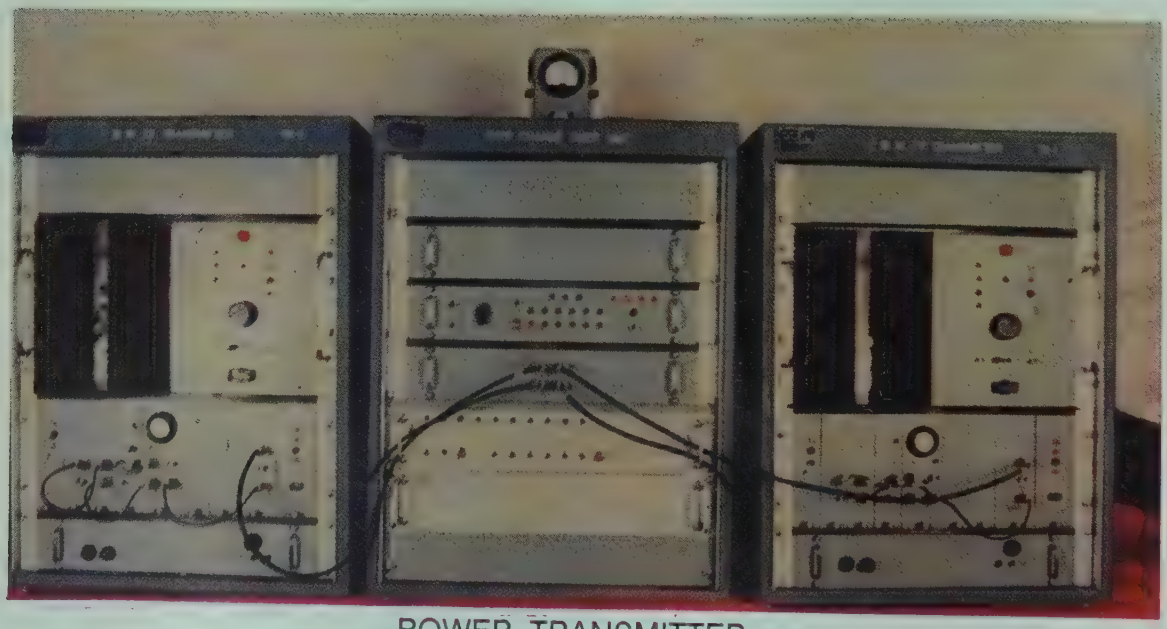
## Remarks :

Testing of the furnace and drier is being carried out in Indonesia in cooperation with Fisheries Research Institute in Jakarta. Appropriate Technology Development Institute (ATDI) have adapted some of the features from this drier to develop and test a cardamon drier.

*Contact* : S. JOSEPH, BEST PTY LTD., 5 KENNETH AVENUE, SARATOGA, NSW 2250, AUSTRALIA




TRANSMISSION AND RECEPTION



POWER TRANSMITTER

# LOW POWER TRANSMITTER

## Description

These transmitters are helpful in covering remote hilly areas and islands under the TV network. These transmitters are unattended and solar powered with a capacity of 10 watts can be easily installed at a modest cost. The entire system operates on rechargeable battery bank which gets charged through on array of solar photovoltaic panels.

## Advantages

Conforms to CCIR 'B' standards; works in conjunction with 'S' band TVR on INSAT network; Automatic Switching on/off with presence/absence of video Sync. in the received S-band signal; redundant operation with cold standby transmitter; Manual Auto mode selection; optional flow control and monitoring facility; switch over from main to standby based ON line testing of health of transmitter; ease of operation; maintenance and installation; low power consumption so as to operate on solar energy. Compact, light weight and tropicalised. A normal installation with omnidirectional antenna is expected to serve the community living within 5km radius. The system has an optional capability to work on 230 VAC.

## Areas of Application

Remote, hilly areas and islands under the TV network

## Stage of Development

operational in India

## Inputs Required

Furnished on request

## Project cost

Furnished on request.

## Terms of Transfer

Licensing and sale

*Contact* : SHRI T.V. PARTHASARATHI, HEAD (MKTG AND SYSTEMS), GUJARAT COMMUNICATIONS AND ELECTRIC LTD., 638, GIDC, IND. ESTATE, MAKARPURAM, BARODA 390 110, INDIA

INSECTS CONTROLLED - CLEAN PRODUCE

## NEEM BASED INSECT CONTROLLING AGENT

### Description

Natural and herbal (neem based) insect controlling agent. Available in a water soluble powder form. Highly active against a wide range of pests due to multiplicity of its constituents and actions. Compatible with conventionally used insecticides, fungicides, herbicides and other agro chemicals.

### Advantages

Longer and comprehensive insect control
Environment friendly and safe
Control during different stages of insect development
Least damage to beneficial insects and predators
Multicomponent formulation
Retards activity of nitrifying bacteria

### Areas of Application

Agricultural crops specially vegetables, fruits and tea

### Stage of Development

Commercialised in India. Patent applications awaiting clearance in India, USA, Japan, Brazil, Europe, Indonesia and Malaysia

### Production Capacity

500 metric tonnes

### Terms of Transfer

Negotiable

### Remarks

Suitable for all types of crops. Dosage 5gm per litre for high volume spray
All other details available on request.

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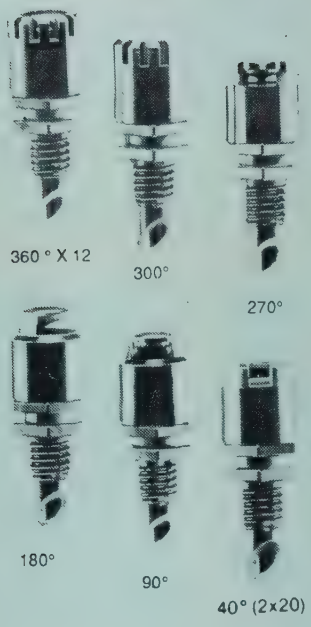
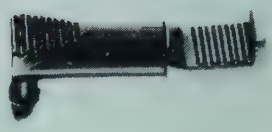
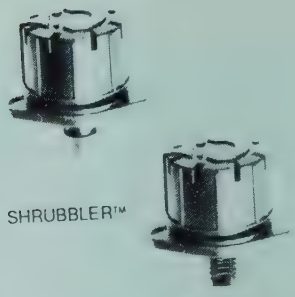
*Contact* : DR B.N. VYAS, MANAGER (AGRICULTURE & RESEARCH), GODREJ SOAPS LTD., PIROJSHANAGAR, EASTERN EXPRESS HIGHWAY, VIKHROLI, BOMBAY - 400 079, INDIA TELEPHONE : 5170861/5171161/5171861 TELEX : 011-71480 FAX : (91-22) 517-1525/517-0479 CABLE : SOAPGODREJ, BOMBAY




SPRAY JETS



MIDI DRIP



AGRI DRIP

DRIP EMITTERS

ROTOR SPRAY

INVERTED ROTOR SPRAY

VARI ROTOR SPRAY

MINI SPRINKLERS

VARIJET 360°

VARIJET 180

VARIJET 90°

VARI JETS

# PLASTIC MICRO IRRIGATION SYSTEM

## Description

This micro irrigation system incorporates a variety of spray patterns and water flow rates facilitating the selection of the correct jet to suit most micro irrigation projects. The range of products include (i) Drip emitters and fittings (ii) Mini sprinklers (iii) Spray jets.

## Advantages

Reduces energy consumption.

Ideal for frequent irrigation application in sandy soils and also where poor lateral water spread is encountered

All components manufactured to ISO standards.

(i) Drip emitters CV +-3% each unit tested after production
(ii) Rotor rain mini sprinkler large droplet size minimizing evaporation

## Areas of Application

Agriculture, horticulture.

## Stage of Development

Commercialized in Australia, USA and Europe

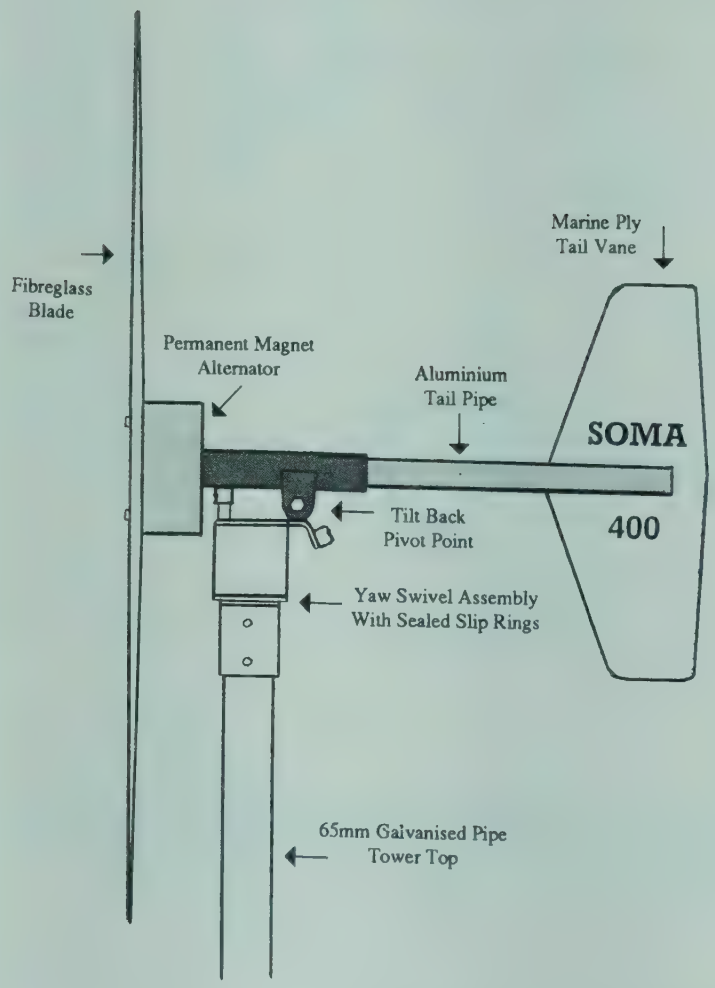
## Inputs Required

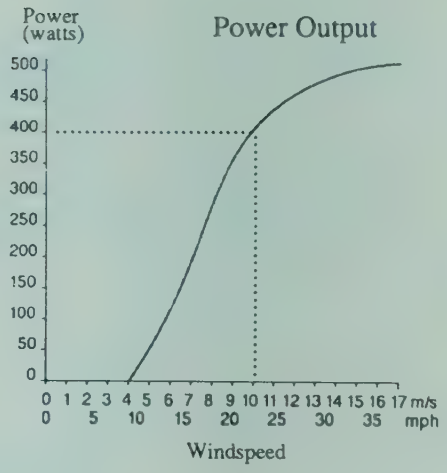
*Raw materials* : Polypropylene, acetal.

## Terms of Transfer

After successful commercialization of products in the local market, arrangements could be made for licensing the technology.

*Contact* : NEIL HAWKES, MARKETING MANAGER, M/S. ANTELCO PVT. LTD., MARKETING RESEARCH OFFICE, UNIT 2, THE PALMS, 62-66 ALEN OSMOND, PARKSIDE, SOUTH AUSTRALIA 5063 ☐ TELEPHONE : 61 83-73-15-88 ☐ FAX : 61 82-71-42-83




SOMA WIND GENERATOR

## WIND GENERATORS

### Description

Wind powered generators of 400 watts and 1000 watts consists of permanent magnet alternators directly driven by two fibreglass blades, and is used as the primary source of power to charge batteries for electric power supply to houses, villages, communication equipment, etc. The alternator is designed in such a way that the power curve is optimally suited to the 2 bladed rotor. The result is high efficiency in light to moderate windspeeds ensuring consistently higher average performance.

### Advantages

Low cost electric power
Simple and well proven design
Uses renewable energy
Low maintenance
Enables use of lights, radio, television, refrigeration, etc.
Simple, clean technology with easy technology transfer possibilities

### Stage of Development

Commercialized for over 14 years in New Zealand, Australia and India

### Inputs Required

*Raw materials* : steel, copper wire, electronic components, fibreglass, wood, aluminium
*Utilities* : Power - 5000 kWh/annum
*Required area* : Indoor 250 $m^2$

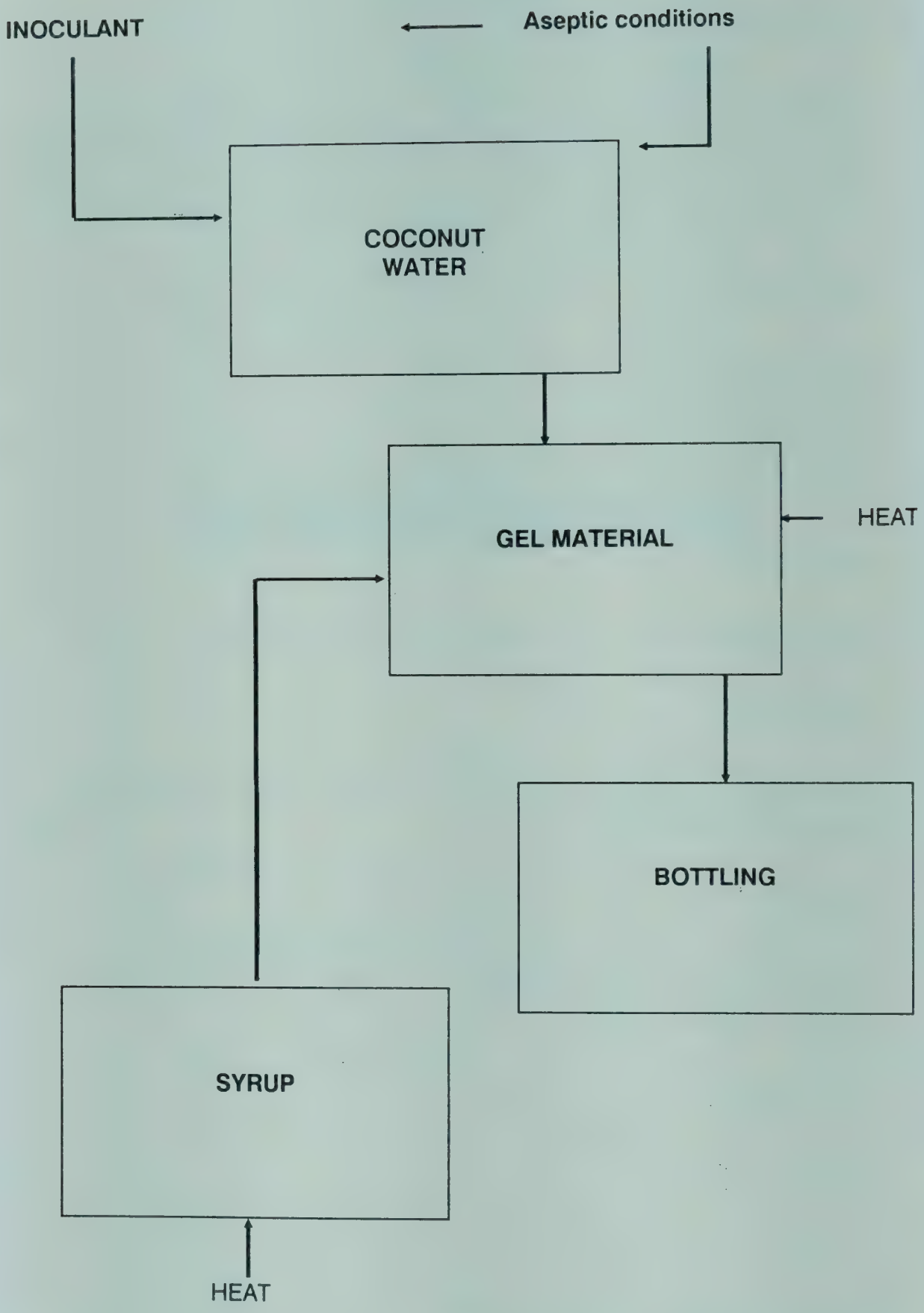
### Project Cost

*Equipment/Machinery (FOB)* : US$34,000
*Operational cost for one year* : US$25,000
(excluding labour and salaries)

### Terms of Transfer

Licensing, Turnkey

Contact : DAVID MACKAY, DIRECTOR, SOMA POWER LTD., P.O.BOX 226, SILVERDALE, AUCKLAND, NEW ZEALAND ☐ TELEPHONE & FAX : (09) 479-1605




PROCESS FLOW DIAGRAM

## COCONUT CHERRY CUBES

### Description

The process involves : (1) Formation or preparation of culture; (2) Production of coconut cherry cubes using a proper medium; and (3) Syruping of coconut cherry cubes. Some of the equipments required are rectangular vessels made up of mild steel and anodized metal containers and heating equipment.

### Advantages

- Agricultural wastes are utilized
- Low investment

### Areas of Application

Food industry. The cubes are ideal as dessert or mixed with ice-creams, fruit salads, cakes and puddings, etc.

### Stage of Development

Commercialised in Sri Lanka

### Production Capacity

60,000 bottles/year

### Inputs Required

*Raw Materials* : Coconut water, sugar and ammonium sulphate
*Required Area* : Building 530 sq.m. Land - 8 sq.m.
*Manpower* : Skilled - 3, Unskilled - 2

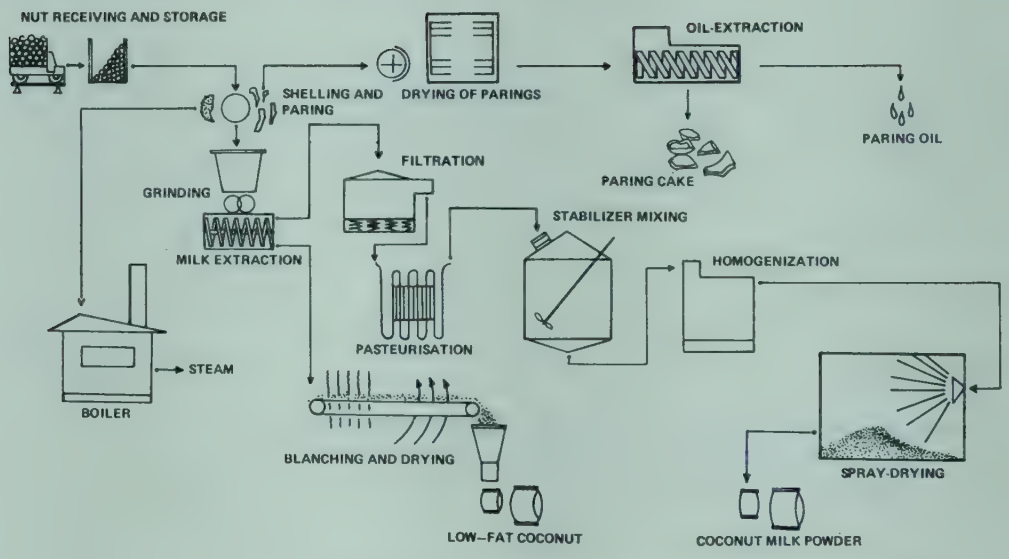
### Project Cost

*Equipment/Machinery* : US$ 14,000
*Fees for technical know-how/training* : US$ 2,000
*Operational cost* : US$ 20,000/year

### Terms of Transfer

Negotiable

*Contact* : DIRECTOR, INDUSTRIAL DEVELOPMENT BOARD, 615 GALLE ROAD, KATUBEDDA, MORATUWA, SRI LANKA




PROCESS FLOW CHART

# COCONUT MILK POWDER

## Description

Coconut milk powder is used as a major ingredient in the preparation of dishes, beverages and desserts typical of the culinary tradition of the Asian region. The product also finds a major market in the Asiatic population of development countries in Europe and the United States who, until this product in powder form was introduced by Red V in 1982, had to contend with using liquid coconut milk in tin cans.

## Advantages

Red V established the first commercially viable manufacturing plant for Coconut Milk Powder in 1981 and has developed the market in the Philippines, Asia and Europe since 1992. By offering a complete package to the project proponents-from providing technology to providing technical assistance in setting up and operating the plant, to providing a marketing channel to the export market- the project proponent is assured of acquiring the benefits from:

* Proven technology and production expertise
* Proven operating systems: production, quality assurance, cost accounting
* Supervision from trained and experienced production personnel
* Hands-on training in existing Red V plants
* Established marketing/distribution channel

## Areas of application

On the consumer market, coconut milk powder is used as a major ingredient in the preparation of dishes, beverages and deserts typical of the culinary tradition in the Asian region.

On the industrial end, the product has found major applications in the dairy industry in the manufacture of ice cream, yoghurts and other chilled or frozen desserts, in the backing industry, food industry in the manufacture of instant mixes, and beverages.

## Stage of development

Commercialized in Philippines in 1982

## Production Capacity

An economically sized plant will have a capacity in the range of 8 metric tons of coconut milk powder per day, based on 3 work shifts.

## Inputs

*Raw materials*: Fresh coconuts, Maltodextrin and Sodium Caseinate
*Utilities* : Water: 5.5 CBM/hr.; Power: 140 kw/hr.; Fuel: 275 kg/hr. of coconut shell for steam generation
*Land/building* : Indoor: 5,000 sq.m; Outdoor: 25,000 sq.m
*Manpower*: Skilled: 50; Unskilled: 240; Total 290

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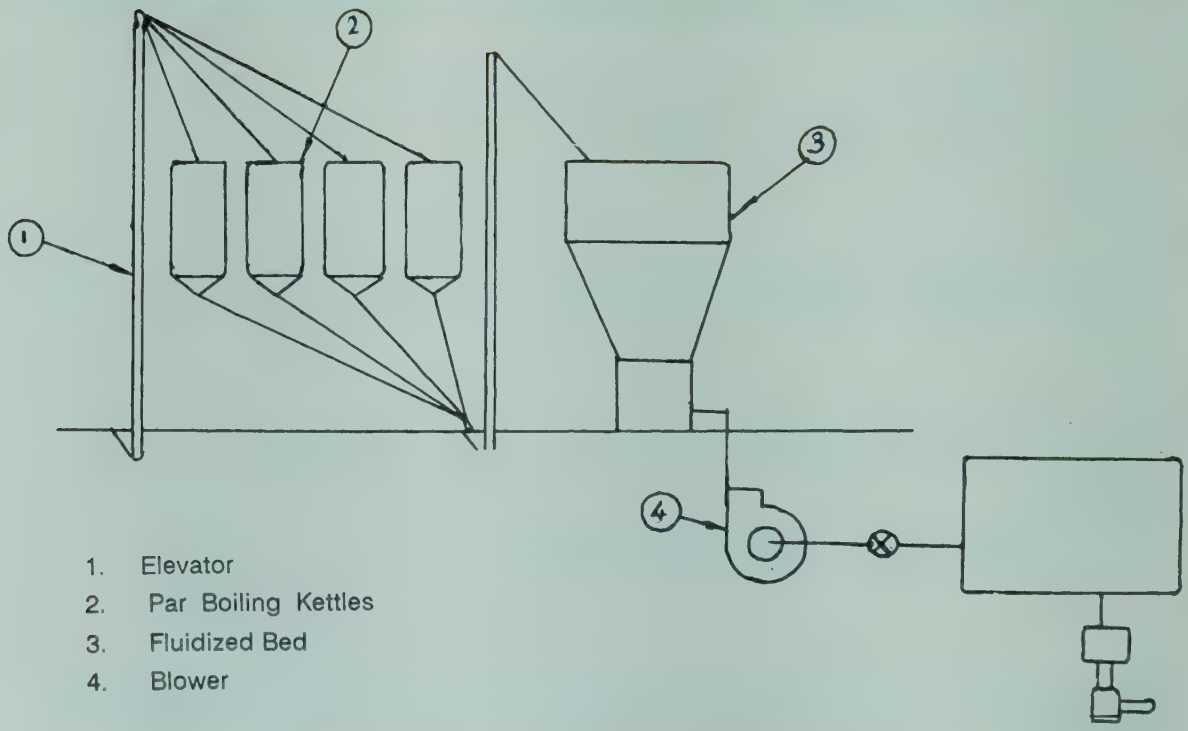
*Contact*: MR.PAUL R.Z.TAYAG, RED V COCONUT PRODUCTS,LTD., P.O.BOX 248 MAKATI, METRO MANILA, PHILIPPINES




1. Elevator
2. Par Boiling Kettles
3. Fluidized Bed
4. Blower

A VIEW OF FLUIDIZED BED DRYER

# FLUIDIZED BED DRYER FOR PARBOILED PADDY

## Description

An efficient low cost fluidized bed dryer for parboiled paddy which utilizes paddy husk as fuel for heating of drying air. The fludized bed drying system essentially consist of the following components:

A fluidized chamber with a perforated bottom; blower driven by 15 kw motor capable of delivering air at a flow rate 8 m3/s static pressure 1000 Pa; and husk fired furnace for generating warm air.

## Advantages

The dryer is capable of drying 0.5 tonnes of parboiled paddy from and initial moisture content of 32% to final value of 14% in one hour.

The total electrical power consumption for drying of one tonne of parboiled paddy is 10% less than the power requirement in an LSV type continuous flow type mechanical dryer.

Grain discolouration and breakage is appreciably less as compared to other methods of mechanical drying because of the uniformity in moisture removal and low temperature drying at 50°C.

Other advantages associated with the fluidized bed dryer are: simplicity of the design; shorter drying time; and elemination of tempering period during drying operation.

## Areas of application

Paddy drying in commercial rice mills.

## Stage of development

Commercialized in 1986 in Sri Lanka.

## Production capacity

0.5 tonnes/hr.

## Costs

Equipment/Machinery (FOB) : US$ 5000; Operational cost for one year:US$ 8000

## Inputs:

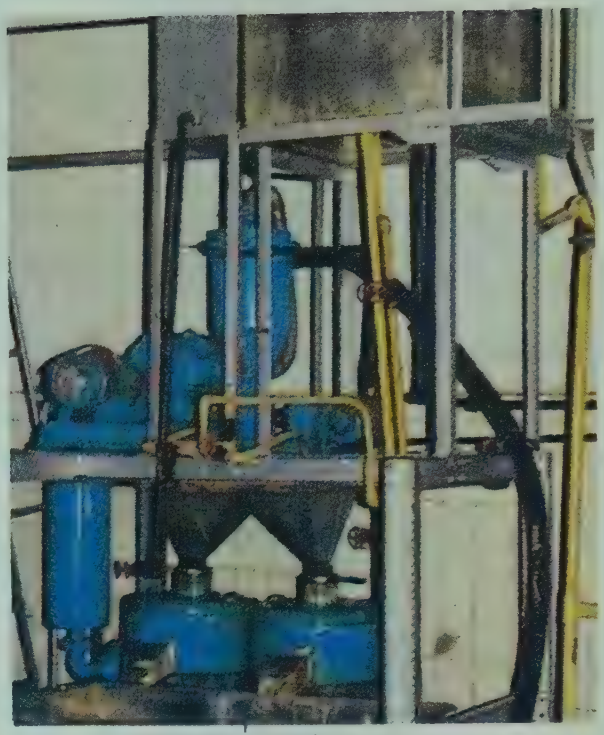
a) *Raw materials* : Rice husk :100 kg/hr.; Electricity:16 kwh; b) Required area : 4x5 m; c) *Manpower* : Skilled : 1; Unskilled : 2

## Terms of Transfer

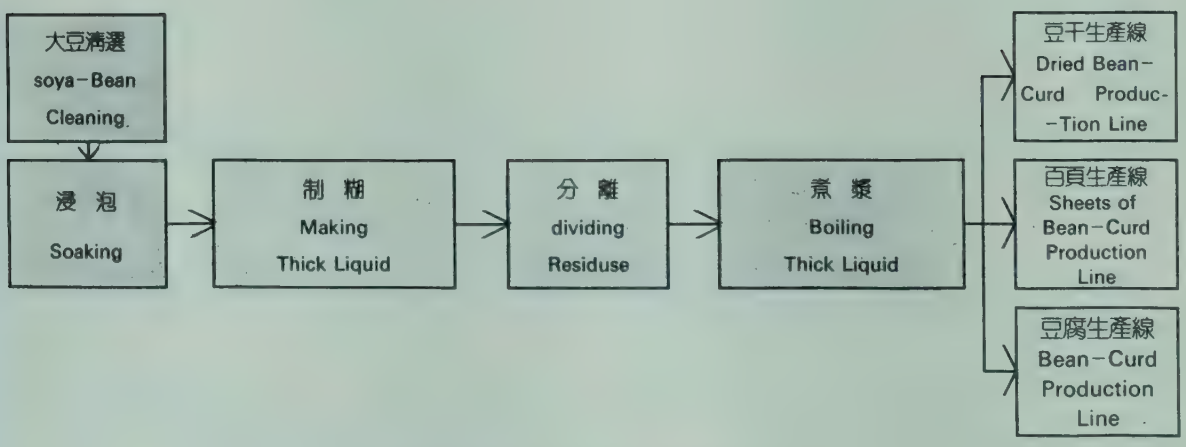
Technical know-how training.

*Contact* : DIRECTOR. RICE PROCESSING RESEARCH & DEVELOPMENT CENTRE. JAYANTHI MAWATHA. ANURADHAPURA. SRI LANKA ☐ TELEPHONE: 025-2344

MODEL DZX 1500
(Boiling System)



MODEL DZX 1500
(Thick Liquid Making System)




TECHNOLOGICAL PROCESS

## MECHANISING SERIES BEAN-PRODUCTION LINES

### Description

The Bean production line is used mainly for the processing of bean-curd, dried bean-curd and sheets of bean-curd. It can be used in different areas and it is fit for all scales of bean-products processing. It can also be applied for the renewal of equipments and the transformation of technology. Production:Model DZX 1500, Model DZX 1000, Model DZX 500.

### Advantages

The technological process of the bean-production line is reasonable. It's easy to form a complete set and is characteristic of seriation. It can adapt itself to pepole's needs for bean-products both in the south and in the north.

The production line is designed separately according to different systems. The different systems are fitted together in a combined way with a compact structure.

It is interchangeable, exchangeable, easy to transport, fix, debug, operate and maintain.

Using this production line can also improve working conditions and ensure food hygine.

The production line is top of mechanization, soil can ease the intensity of labour, raise work efficiently and reduce consumption.

### Areas of Application

Iron & steel companies, Chemical industries, Oil fields, Coal mines army units and it also be used in small, medium and large cities bean-production factories.

### Stage of Development

1985 in China. In recent years, people in Europe and America have become more and more interested in bean products, which are thought to be "plant meat".

### Annual Production Capacity in (m,m2,m3,t,pcs)

100-200 bean-production lines.

### Inputs

a) Raw materials :Bean; b) Utilities: Power : 55KW/annum for DZX 1500; 50.4KW/annum for DZX 1000; 41KW/annum for DZX 500; Water : 22.5T for DZX 1500; 15T for DZX 1000; 7.5T for DZX 500; c) Required area : 400 sq.m for DZX 1500; 250 sq.m for DZX 1000; 150 sq.m for DZX 500

### No.of Employees

Unskilled : about 14; Skilled : about 5; Tech.Staff : about 1; Others : 3;

### Project Cost (in US$ excluding land & building)

DZX 1500 - 371,250; DZX 1000 - 206,250; DZX 500 - 137,500

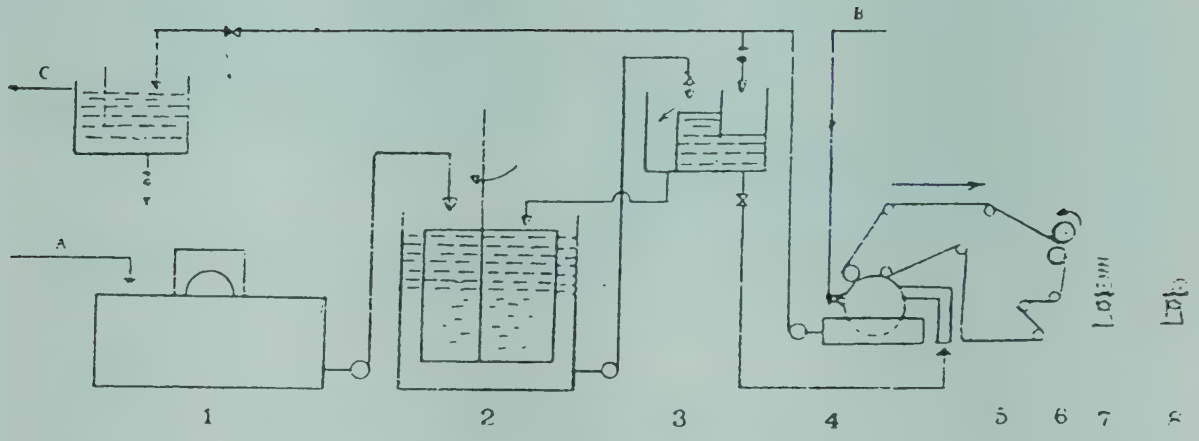
### Ecological/Environmental Aspects:

No pollutants.

### Terms of Transfer

Negotiable

*Contact* : MRS. ZHENG TONG QING. TIANJIN FOREIGN TRADE CORPORATION. 59, NANJING ROAD, TIANJIN, P.R. CHINA. ☐ TELEPHONE: 31.6551 ☐ TELEFAX : 022-314339




1. Beater
2. Pulp storage
3. flow control
4. board printer
5. Transfer belt
6. Roller
7. Polisher
8. Cutter

A. Waste paper
B. Cleaner
C. Waste water

SCHEMATIC DIAGRAM

## PAPER BOARD PRODUCTION UNIT

### Description

The production unit consist of 4 machines, 2 pumps and 3 reservoirs.

### Advantages

The techniques and machineries are simple, suitable for small scale industries to create job opportunities. Raw materials is unbleached pulp, paddy straw or waste paper. The raw material is easily obtained, the product can be adjusted according to the market demand.

### Areas of Application

* Paper board for making boxes for packaging of food, ceramics, glass, etc.
* Paper board for hard cover

### Stage of Development

The development was started in 1970 as modification from traditional technology. More efficient use of raw material and energy have been developed to produce better quality of paper board.

### Production Capacity

With these equipment, the recommended scale of production is 500 kg/day (7-8 hours operation per day). The break even capacity is 165 kg/day.

### Inputs Required

*Raw material* : unbleached pulp, paddy straw, waste paper
*Utilities* : water + or - 1 $m^3$/day, fuel consumption + or- 30 1/day (diesel mover, 40 Hp)
*Land/Building* : Indoor - 150 $m^2$; Outdoor - 900$m^2$ (for drying)
*Manpower* : Skilled - 1 person; Unskilled - 5-8 persons

### Project Cost

*Equipment (FOB)* : US$15000
*Operational Cost* : US$ 11,400

### Terms of Transfer

Turnkeyp; Joint Venture

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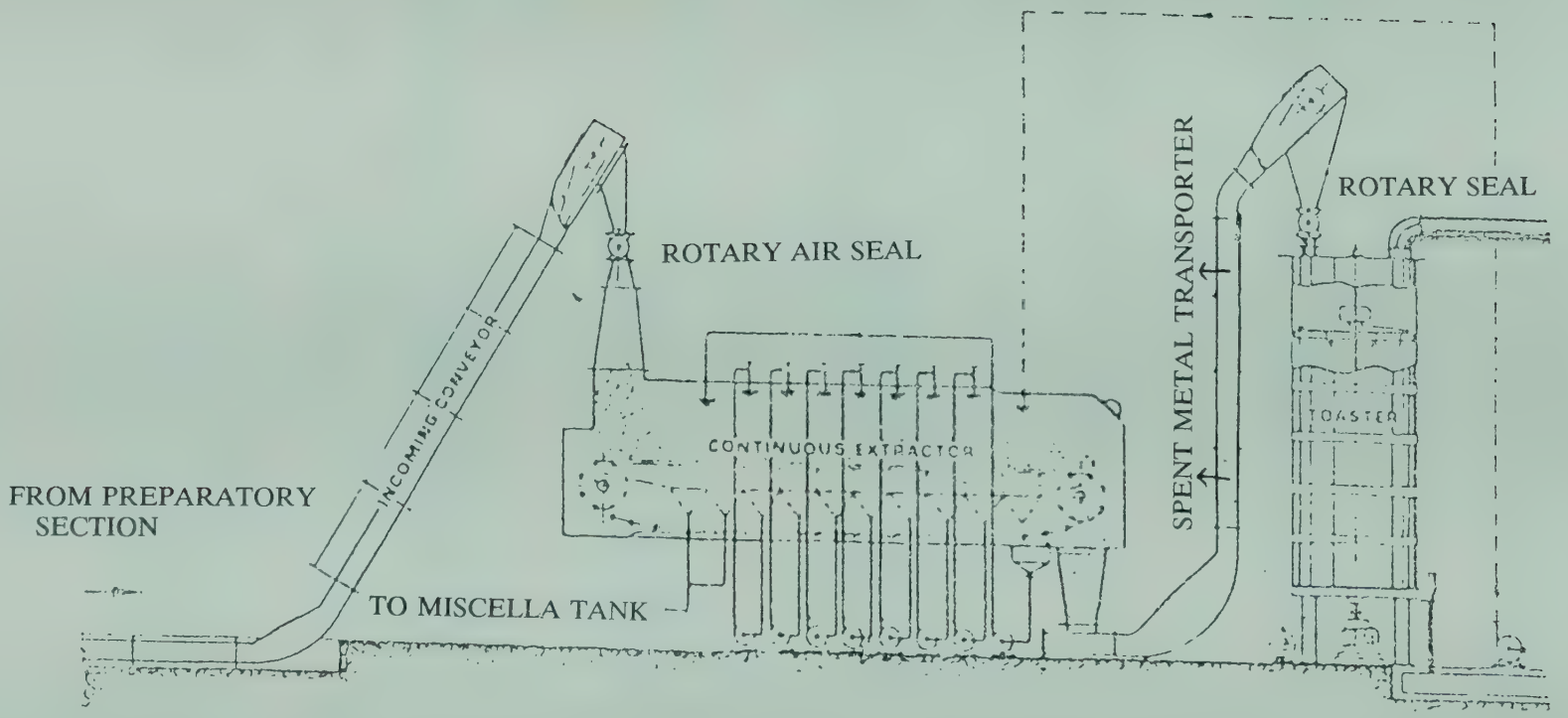
*Contact* : INSTITUTE FOR RESEARCH AND DEVELOPMENT OF CELLULOSE INDUSTRIES, DEPT. OF INDUSTRY, 158 JLN. RAYA DAYEUHKOLOT, BANDUNG ☐ TELEPHONE : 59812/50623

EXTRACTION

DESOLVENTISING




PROCESS DIAGRAM

## VEGETABLE OIL EXTRACTION BY FLUIDIZATION TECHNIQUE

### Description

A process using continuous fluidization technique to extract crude vegetable oil or edible oil. Oil in vegetable seeds or rice bran is extracted continuously by hexane. More than 98% of the oil is removed in five stages of fluidized bed. Multi-column counter-current operation technique is used.

### Advantages

Waste reduction.
High efficiency in oil extraction.
Low energy consumption.
Low investment.

### Areas of Application

Food industry.

### Stage of Development

Commercialized in Thailand

### Inputs Required

*Raw materials* : Vegetable oilseeds or rice bran
*Utilities* : Power - 10hp, Fuel - 100 l/hr
*Required Area* : Building : 64 sq.m., Land : 50 sq.m.
*Manpower* : Skilled - 2, Unskilled - 4

### Project Cost

*Equipment/machinery* : US$ 40,000 plus US$ 200,000 for distillation unit.
*Fees for technical know-how/training* : US$ 25,000.
*Operational cost* : US$ 113,000/year

### Terms of Transfer

Licensing, Turnkey

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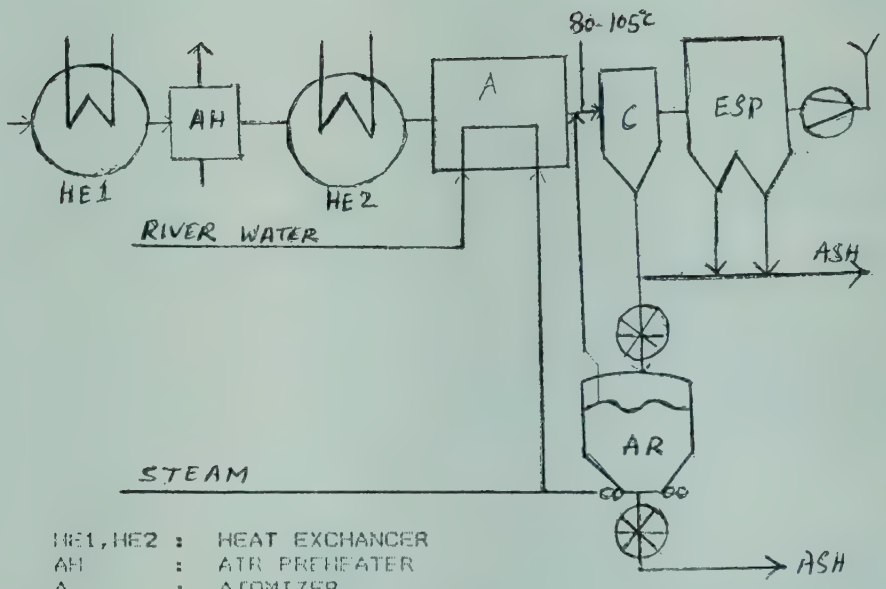
*Contact* : SOMSAK DAMRONGLERD, SHOOSHAT BARAME, DEPARTMENT OF SCIENCE, CHULALONGKORN UNIVERSITY, BANGKOK 10330, THAILAND




FLOW SCHEME FOR ARA PROCESS

## ASH-RECYCLE-ACTIVATION (ARA) PROCESS

### Description

This is a new process for removing Sulphur Dioxide ($SO_2$) from flue gas. When used in combination with furnace limestone injection (FLI) process, the ARA process gives an efficiency of 90% and more. The ARA process uses a mixture of fly ash and CaO sorbent that comes out of furnace for further $SO_2$ removal. The flue gas is cooled to a temperature of about $90^{\circ}$ C. The dust is separated from the flue gas, treated with low pressure steam and then added to the flue again.

### Advantages

* Pollution control through efficient $SO_2$ reduction.

* Easy to operate. A totally dry process that allows the useage of carbon steel materials.

* Low operational cost and investment.

### Areas of Application

For the reduction of sulphur dioxide emissions from coal fired power plants.

### Stage of Development

Patented in Austria (Pilot plant stage)

### Production Capacity

(i) Cleaned flue gas stream (depending on the size of the firing unit - no limitation in size); (ii) Solid waste product (depending on ash and $SO_2$ content of fuel and fuel consumption).

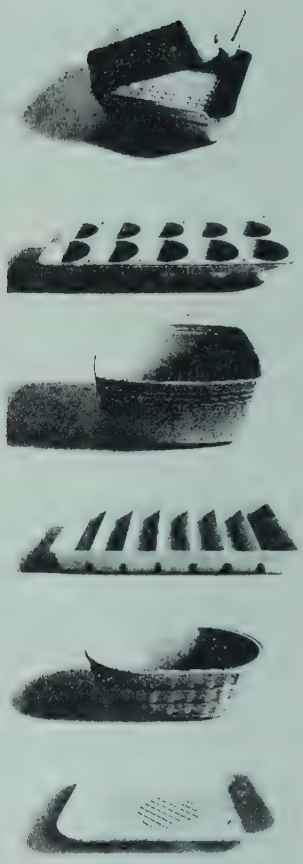
### Inputs Required

*Raw materials* : Limestone, flue gas;
*Utilities* : Power - about 7KW/Mw equivalent of the firing unit, Water - river water, injection cooling, Others - air; pressurized air for atomization of injected water;
*Required area* : Building - 200 to 400 sq. m.
*Manpower* : Skilled - 1 or 2 in normal operation

### Terms of Transfer

Licensing, Subcontracting, Basic engineering design

*Contact* : G. STAUDINGER, PROFESSOR, GRAZ UNIVERSITY OF TECHNOLOGY, INFFELDGASSE 25, A-8010 GRAZ, AUSTRIA



Nach einer Woche.
**After one week.**

Nach zwei Wochen.
**After two weeks.**

Nach drei Wochen.
**After three weeks.**

# BIODEGRADABLE PACKAGING MATERIAL

Description

Biological packaging are - as the name suggests - biologically decomposable products consisting of agricultural raw materials produced from industrial starch. The product is suitable for industrial production of large quantities and can replace traditional types of packaging. It is sturdy, suited for microwaving and freezing, and can also be stored for virtually unlimited periods. The one difference is that it completely degrades after use - within a few weeks.

**Advantages**

It is made of biological raw materials which are renewable and produced in excess worldwide (starch). The raw material starch is extracted from fast growing plants by means of simple procedures. The material decomposes (e.g. if exposed to lasting rain) and is decompounded biologically by 100%. It does not contain any ingredients which are not subject to biological decomposition. It contributes to a dramatic reduction of the garbage volume. No petrol chemical raw materials are used. Thus the decreasing crude oil resources are economized. Production of this packing makes good use of agricultural overproduction.

**Areas of application**

The biological packing is especially suitable for sorting dry charge or goods having a low percentage of humidity (water content not less than 16%) and for temporary use with moist, nondripping goods. A few examples of applications are: for pastry, candies, ampules, fast food, various throw-away boxes.

**Stage of Development**

Patented; Commercialized 1990

**Composition**

The biological packing mainly consists of native industrial starch. The raw materials used are potato starch, maize starch and similar raw materials having a high content of starch. Moreover plant fibres and the so called "premix" are used. The premix consists of various food additaments and helps - applied at a low percentage - enhance stability and moulding properties of the product.

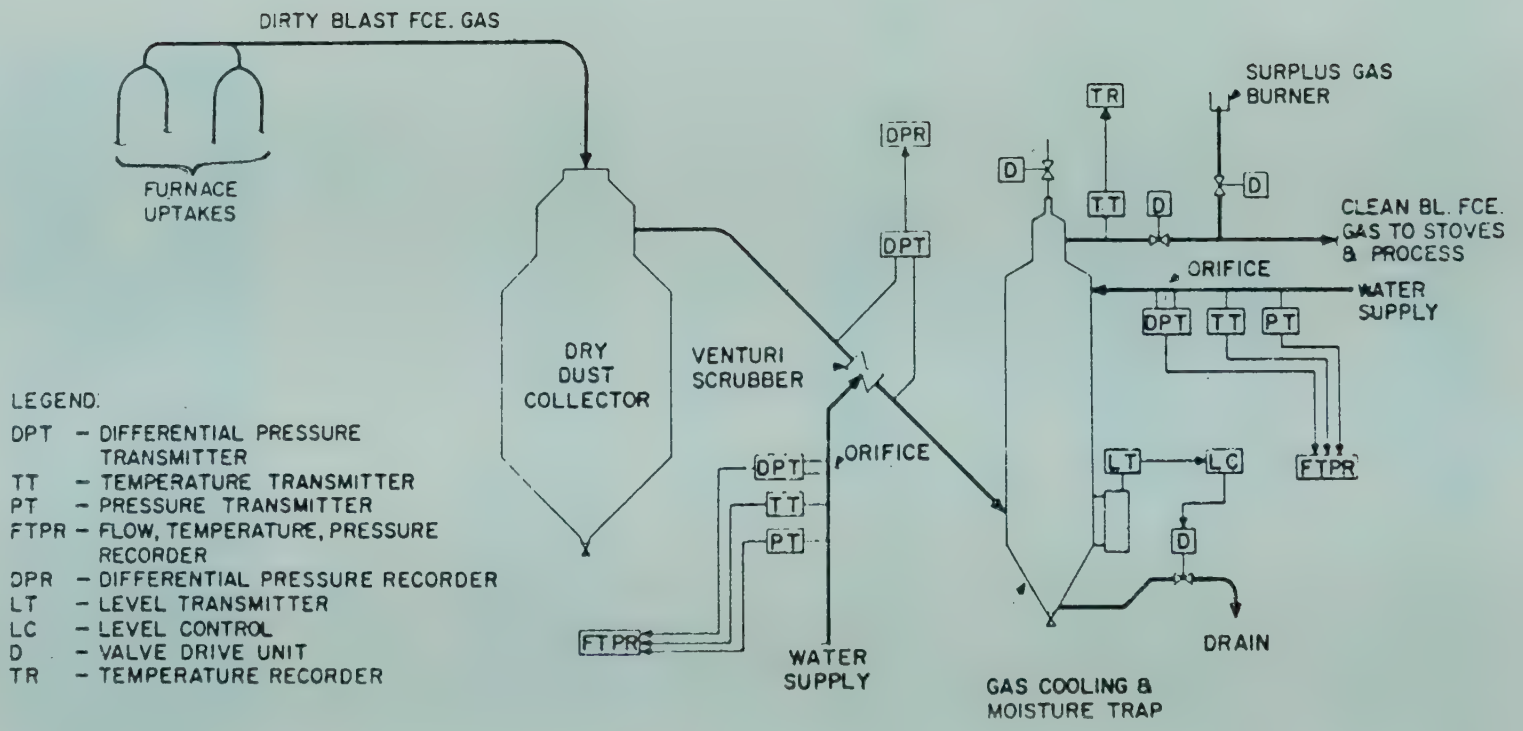
**Production costs/year**

| | |
|---|---|
| a) Depreciation (5 years) | A$3,000.000 |
| b) Maintainance | A$ 500.000 |
| c) Energy | A$1,000.000 |
| d) Wages (3 persons/shift/@ A$ 300.000) | A$1,800.000 |
| e) Raw material | A$5,000.000 |
| f) Licence (4000 hours @ A$ 500.000) | A$2,000.000 |
| Total | A$13,000.000 |

**Terms of Transfer**

Licensing; Joint Venture

*Contact* : MAG.ERNEST KROTTENDORFER. BIOPAC. BIOLOGISCHE VERPACKUNGSSYSTEME G.M.B.H. PRAGER STRALSE 124, POSTFACH 56. 1212 WIEN. AUSTRIA.




BLAST FURNACE GAS CLEANING SYSTEM

# BLAST FURNACE GAS DRY BAG DUST REMOVAL TECHNOLOGY

## Description

This dust removal system is used in fine dry cleaning for high temperature gas from blast furnace. Therefore, physical energy of gas heat and pressure can be fully utilized. It is characterized by automatic and semi-automatic operation of the internal filter, below intake, high pressure difference intermittent reverse blowing system and pressured closed circuit reverse blowing means controlled by PLC programme with reliable operation and high dust removal efficiency (more than 99.8%). A mechanical system is used to discharge and transport the dust collected by the bag deduster. In order to maintain continuous running of the bag deduster, a gas temperature control device is installed in the system according to the material properties of the filter and requirements of process.

## Advantages

Compared with the wet dedusting system, cleaned gas has:
Lower dust content and water content
Higher temperature
Better quality, saving water and power
Operates without environment pollution caused by the scrubbing water
Provides better economic and social benefits.

## Areas of Application

To cleanblast furnace gas

## Stage of Development

The pilot running has been carried out at Lian Yuan Iron and Steel Works in Hunan province in 1985. Technical expertise of this system was adopted by China Metallurgical Industry in June 1986. This system has now been adapted widely for medium sized blast furnaces in China, and soon will be developed into large size blast furnace.

## Inputs Required

*Raw materials* : Steel products - 180t; Cement - 190t; Wood - 016m$^2$
*Utilities* : Power - 100,000 kWh/annum; Water - 300t/annum
*Required Area* : Indoor - 100m$^2$; Outdoor - 500m$^2$

## Project Cost

*Capital Investment of process system* : Approx. R.M.B. 920,000 Yuan
*Process equipments* : Approx. 450,000 Yuan R.M.B.
*Operational cost for one year* : Approx. 20,000 Yuan R.M.B.

## Terms of Transfer

Sub-contracting, Turnkey

---

*Contact* : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245

**Models of Purifier Muffle**

| Models | External size (mm) | External shape | Weight (kg) | Exhaust rate and power of enbines suitable to be equipped (L/PS) |
|---|---|---|---|---|
| QJ-15A | 140*95*140 | Elliptic cylinder | 2.1 | 0.999～1.58/45～75 |
| QJ-15B | 140*95*280 | Elliptic cylinder | 3.7 | 0.999～1.58/45～75 |
| QJ-15 | O140*340 | Cylinder | 4.2 | 0.999～1.58/45～75 |
| QJ-20A | 140*95*340 | Elliptic cylinder | 4.5 | 1.585～1.995/75～95 |
| QJ-20 | O140*415 | Cylinder | 5.83 | 1.585～'.995/75～95 |
| QJ-25 | O 140*480 | Cylinder | 6.95 | 2.1～2.5/75～95 |
| QJ-30 | O 140*625 | Cylinder | 8.6 | 2.5～3.0/95～115 |
| QJ-40 | O 140*705 | Cylinder | 9.2 | 3.0～5.5/115～135 |

## CATALYTIC PURIFIER MUFFLE FOR AUTOMOBILE EXHAUST

### Description

This automobile exhaust muffle makes use of a high quality catalyst.

### Advantages

Cost-effective product; Controls environmental pollution of exhaust and noise from gasoline-fueled vehicles; In slowing-down, the exhaust pollution can be well controlled in compliance with the national standards; Has a muffling effect - the noise can be controlled at a level of 4-6dBA lower than that required by national standards; Has a long working life; Power characteristics and fuel consumption of the vehicles equipped with this product are comparative with those equipped with an original muffle; Has a resistance to lead poisoning and this is applicable to vehicles fueled with either leaded or unleaded gasolines; Can be easily substituted for an original muffle simply by removing the latter from a vehicle.

### Areas of Application

Automobile industry

### Stage of Development

Patented in China

### Production Capacity

100,000 pcs/year

### Inputs Required

*Raw materials* : Ceramics and catalyst;
*Required Area :* Building - 1500 sq.m.;
*Manpower* : Skilled - 13, Others - 5

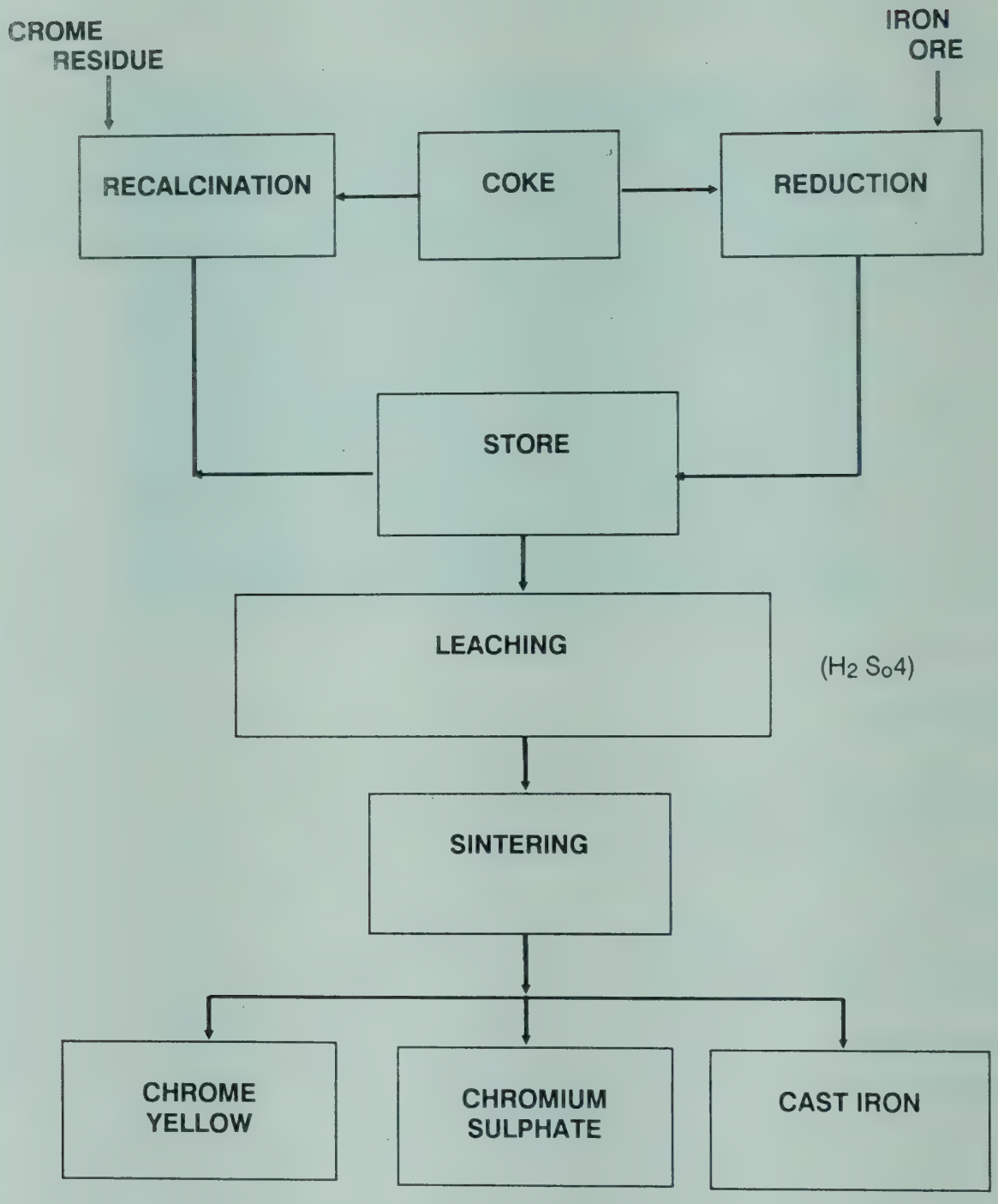
### Project Cost

*Equipment/machinery* : US$ 600,000.
*Knowhow fee* : US$ 60,000

### Terms of Transfer

Licensing; subcontracting

*Contact* : HUANG GUANG-YAO, MANAGER, RESEARCH CENTRE FOR ECO-ENVIRONMENTAL SCIENCES, ACADEMIA SINICA, P.O.BOX BEIJING 934, 100083 CHINA (P.R) ☐ TELEPHONE : (01) 284771 ☐ FAX : (01) 284896




MAIN PROCESSING STEPS

## LEACHING, SMELTING AND DETOXIFYING OF CHROMIUM RESIDUE

### Description

The products are chrome yellow; chromium sulfate (basic); and low-chromium cast iron.The process is to detoxify the toxic chromium residue from production process in chromate chemical factories through four steps: re-calcination, leaching, sintering and avoiding re-pollution.

### Advantages

To prevent chromium residue pollution and exploit resources comprehensively, solving problem of re-pollution and ensuring environment protection.
Environmentally, socially and economically viable.

### Areas of Application

For treating residue containing chromium from chromate chemical factories.

### Stage of Development

### Inputs Required

*Raw materials* : Chromium residue - 10,000 tons, Iron ore - 13021 tons, Coke - 9624 tons, Lead nitrate - 2354 tons, sulfuric acid - 1365 tons
*Utilities* : Power - 5,000,000 kWh/annum; Water - 107 t/h
*Required Area* : Indoor - 4900 $m^2$

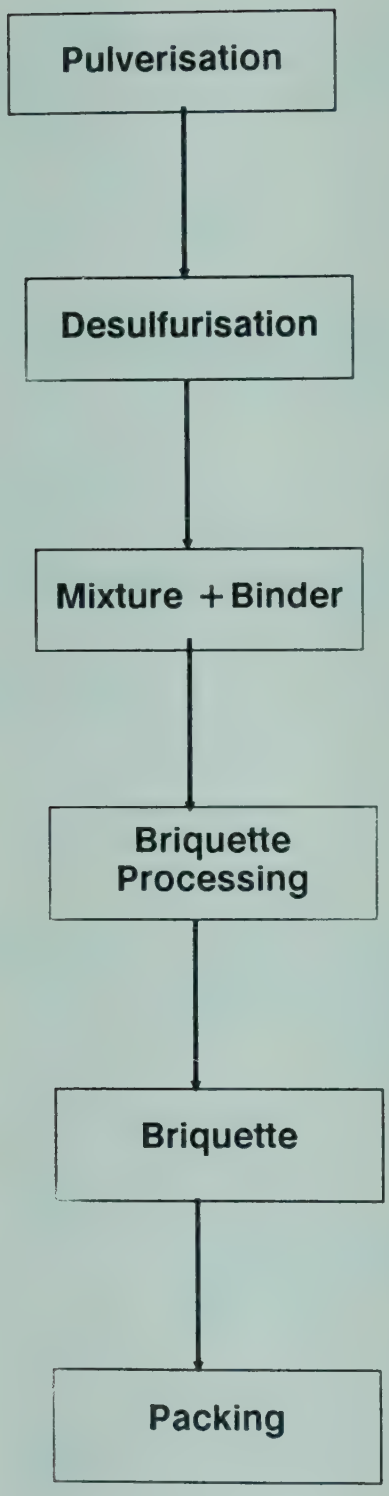
### Project Cost

*Equipment/Machinery (FOB)* : US$1,000,000
*Operational cost for one year* : US$1,770,000

### Terms of Transfer

Investment, Turnkey

*Contact* : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245




FLOW DIAGRAM

## PRODUCTION OF ENVIRONMENTALLY SAFE COAL BRIQUETTES FROM HIGH SULPHUR COAL

### Description

Production technology for an environmentally safe/domestic fuel.

### Advantages

A replacement for kerosene, wood and charcoal.
Low air pollution.
Less odour.

### Areas of Application

Domestic and commercial cooking and space heating.

### Stage of Development

Commercialised in Pakistan

### Production Capacity

50,000 M/T per annum

### Inputs Required

*Raw materials* : High sulphur coal
*Required Area* : Building - 850 sq.m., Land : 13,150 sq.m.
*Manpower* : Skilled-3, Unskilled-9

### Project Cost

*Equipment/machinery* : US$ 350,000
*Operational cost* : US$ 2,320,000/year

### Terms of Transfer

Licensing, subcontracting, turnkey

---

*Contact* : AZIZ A. KHAN, MANAGING DIRECTOR, SCIENTIFIC AND TECHNOLOGICAL DELOPMENT CORPORATION OF PAKISTAN (STEDEC) FEROZEPUR ROAD, LAHORE, PAKISTAN ☐ TELEPHONE : 877-648 ☐ FAX : (042) 874-945

## PERSISTENCE OF PESTICIDES IN SOILS

| Pesticide | Approximate time for 70-95% loss[a] |
|---|---|
| DDT | 4 - 10 yrs |
| Toxaphene | 2 - 10 yrs |
| Dieldrin | 3 - 8 yrs |
| Lindane | 3 - 6 yrs |
| Chlordane, heptachlor | 3 - 5 yrs |
| Aldrin | 2 - 3 yrs |
| Picloram | 1 - 2 yrs |
| Simizine, atrazine | 10 - 12 months |
| Monuron, fenuron, diuron | 8 - 10 months |
| Trifluralin | 6 months |
| Carbaryl, carbofuran | 4 - 6 months |
| 2,4, 5-T | 3 - 5 months |
| Parathion, chlorpyrifos, diazinon | 3 - 6 months |
| Amiben, dicamba, MCPA | 2 - 3 months |
| Dalapon, propham, CDAA, CDEC, EPTC | 1 - 2 months |
| Phorate, disulfoton | 2 - 6 weeks |
| 2,4-D | 4 - 6 weeks |
| Captan | 3 - 6 weeks |
| Malathion | 1 - 2 weeks |

[a] Data from ENCYCLOPEDIA OF ENVIRONMENTAL SCIENCE AND ENGINEERING. (1992 Ed.)

## PURIFICATION OF SOILS FROM PESTICIDE RESIDUE

### Description

The process includes a quantitative assessment of soil purification period of various pesticide residues on a basis of managing the relationship between microbial biomass, values of pH and exchangeable (Ca + Mg) in soils. It is possible to control this process by using fertilizers and lime. A special computer program has been developed for calculation of various rates of agrochemicals as well as for automatic mapping of areas on the basis of their self-purification capacity. The pesticides tend to be in the soil for long periods, thereby getting into the crops and ultimately to the human system. Table shows the approximate persistence of pesticides in soils.

### Advantages

Minimization of negative influence of pesticides and their residues on the soil.

### Areas of Application

Agricultural, agrochemical and environmental centres, plants and laboratories.

### Stage of Development

Patented in Russia

### Production Capacity

4,500-5,000 soil samples per laboratory per year

### Inputs Required

*Raw materials* : 2-10 t/ha of lime, fertilizers
*Manpower* (for one laboratory) : Skilled - 2; Technicians - 5; Unskilled - 5.

### Project Cost

*Equipment/machinery* : US$ 2,200
*Operational cost* : US$ 890/year

### Terms of Transfer

Licensing; joint venture

*Contact* : VLADIMIR BASHKIN, HEAD, LABORATORY OF BIOGEOCHEMISTRY AND AGROLANDSCAPES, INSTITUTE OF SOIL SCIENCE AND PHOTOSYNTHESIS, PUSHCHINO, MOSCOW REGION 142292, RUSSIA
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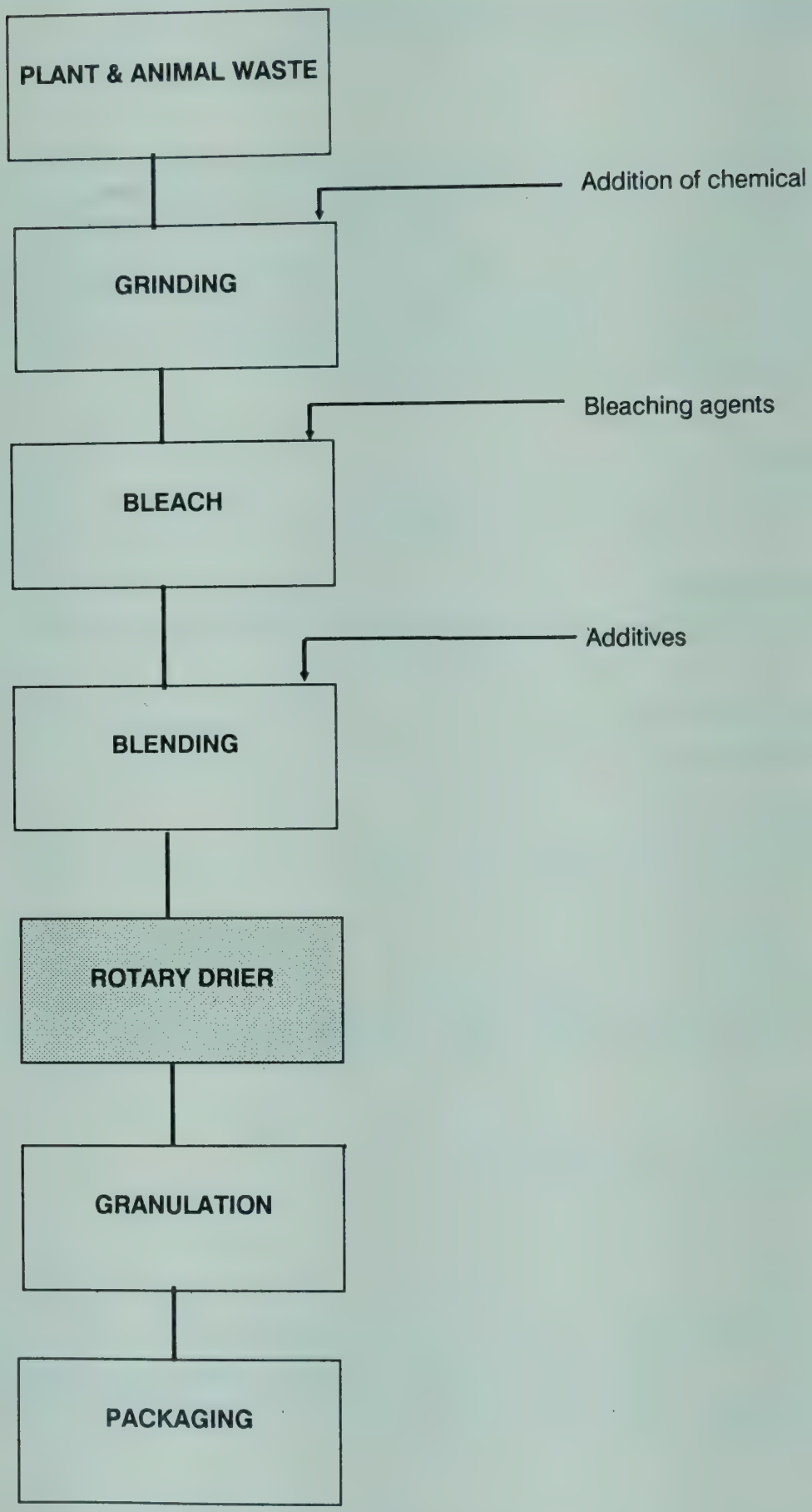


PROCESS FLOW DIAGRAM

## BIO-ORGANIC FERTILIZER

### Description

The process involves gestation with concentrates, addition of initial chemicals, grinding, bleaching, blending with final additives, drying in a rotary dryer, granulating and packaging in 50 kg bags.

### Advantages

Stabilizes the soil
Retains water being spongy
Environmentally safe

### Areas of Application

Can be used as a general purpose fertilizer in agriculture

### Stage of Development

Commercialised in Nigeria since 1991

### Production Capacity

Around 5,500 tons/year

### Inputs Required

*Raw materials* : All plant and animal waste
*Utilities* : Water - 800,000 gal/year;
*Required Area* : Indoor - 350,000 sq.m.; Outdoor : 900,000 sq.m.
*Manpower* : Skilled - 5, Unskilled - 15

### Project Cost

*Equipment/machinery* - US$ 950,000
*Licensing fee* - US$ 150,000
*Operational cost* : US$ 150,000/year

### Terms of Transfer

Licensing

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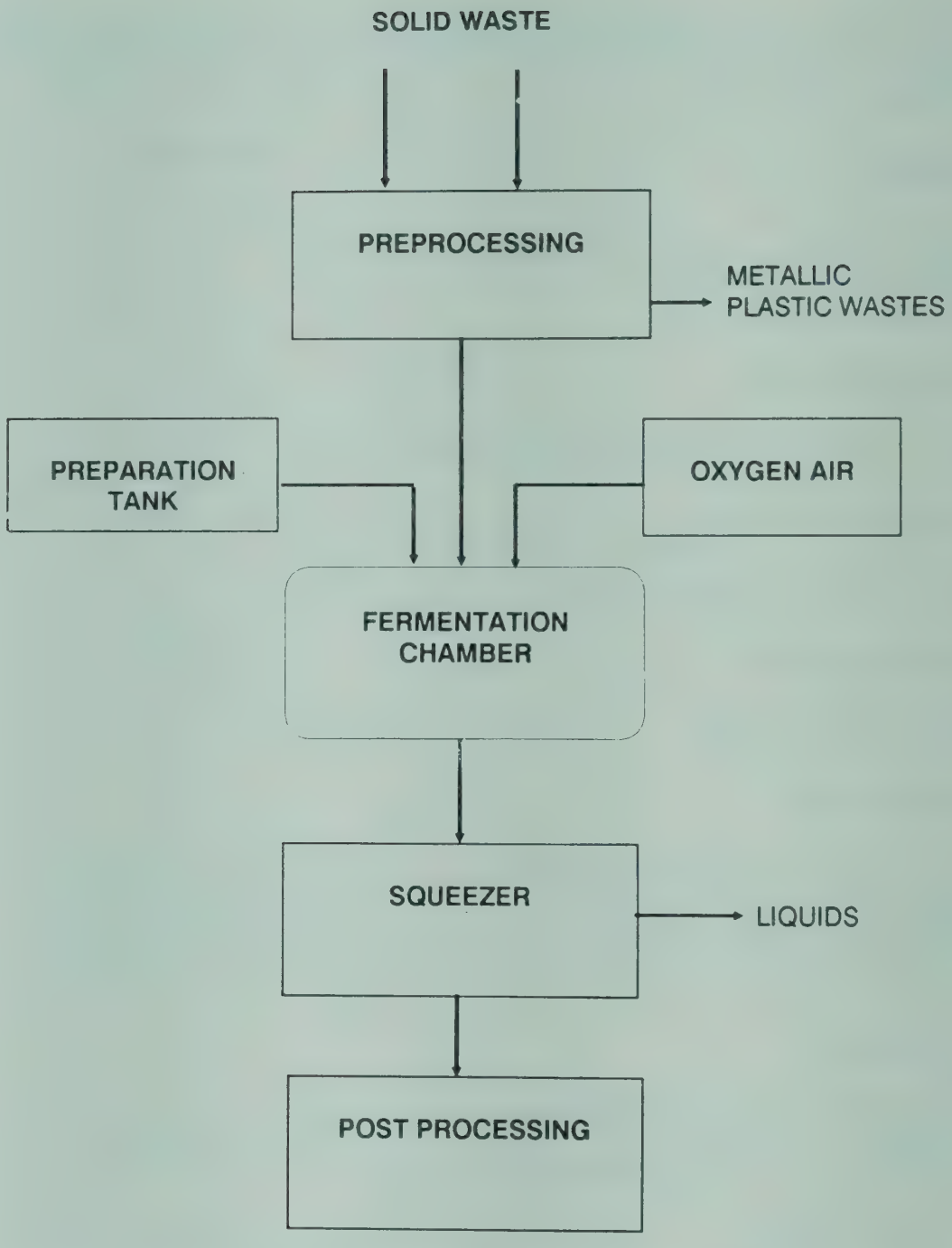
*Contact* : ONWUAGANA SNR, DATTGIP AGRO ALLIED INDUSTRIAL RESEARCH CENTRE, BOX 85, NTEJE ANAMBRA, NIGERIA




AN OUTLINE OF THE PROCESS

# COMPOSTING OF MUNICIPAL SOLID WASTES

## Description

The main process consists of three parts, viz., i) Pre-process; ii) Fermentation [twice]; and iii) Post-process. Waste is transferred into a fermentation chamber, which is shaped into a truncated pyramidal structure and is squeezed out from the chamber once daily. In the meanwhile, the fermenting material degrades, thus making the fermentation somewhat intermittently dynamic and continuous.

## Advantages

Shorter fermentation period [around 96 hours].
Cost-effective.
Environmentally cleaner process.
Waste utilization and manufacture of value-added products. Occupies smaller area.

## Areas of Application

Composting of municipal solid wastes and agricultural wastes.

## Stage of Development

Patented and commercialized in China.

## Terms of Transfer

Licensing, equipment supply.

## Production Capacity

100 - 500 t/day of treated solid waste

## Inputs Required

*Raw Materials* : Agricultural and Municipal Solid Wastes
*Utilities* : *Power* - 55,000 kWh/annum
*Required Area* : i) Indoor - 3,000 sq.m. ii) Outdoor - 20,000 sq.m.
*Manpower* : Skilled - 11, Unskilled - 8

## Project Cost

*Equipment/Machinery* : US$ 1.16 million

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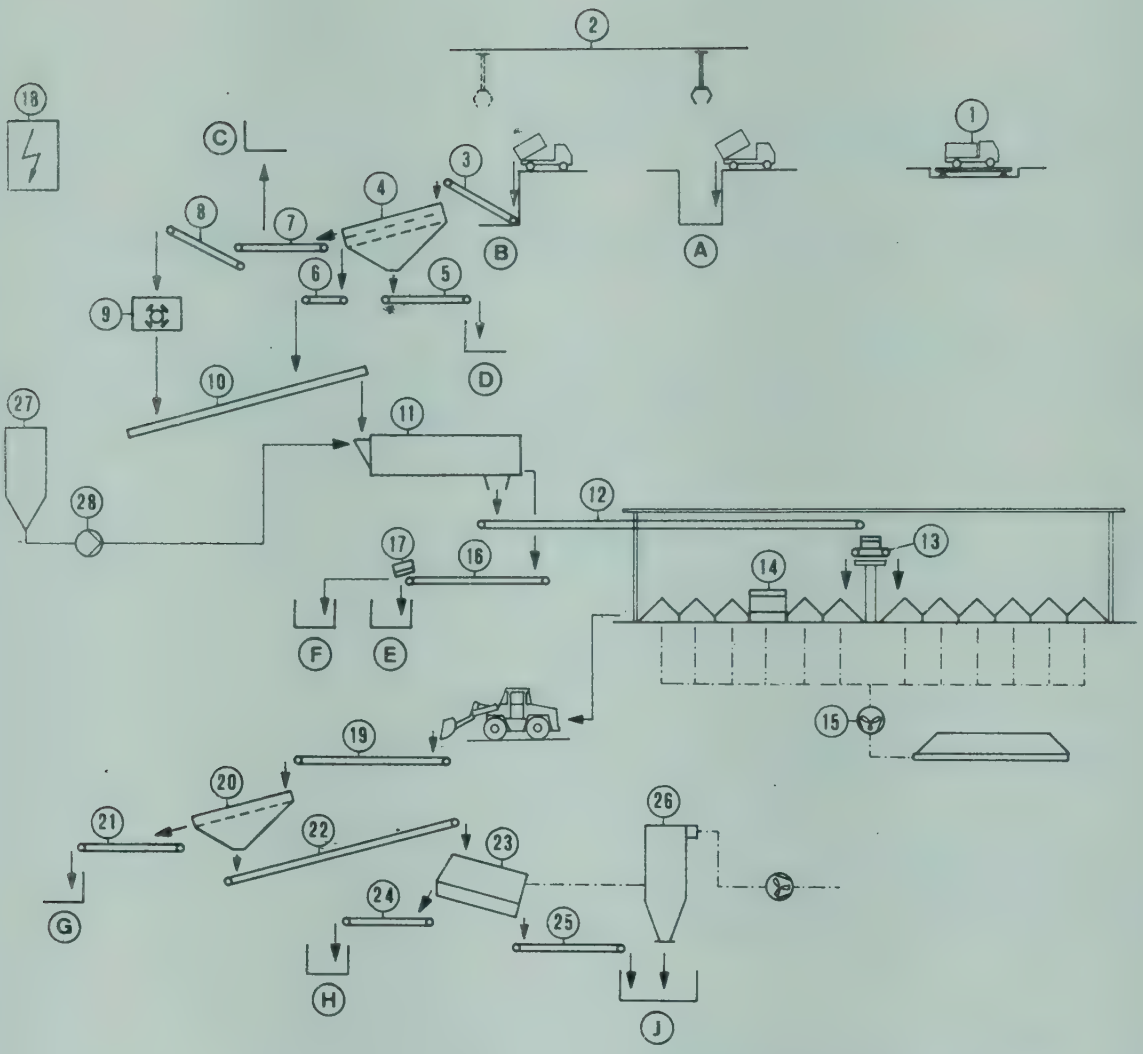
*Contact* : ZHENG TONG QING, TIANJIN FOREIGN TRADE CORPORATION, 59, NANJING ROAD, TIANJIN 300050, CHINA (P.R)☐TELEPHONE : (022) 31-6551-310922☐TELEX : 234117 TFTC CN☐FAX : (022) 314339



1. Weighbridge
2. Grabbing crane
3. Slat conveyor
4. Pre-separator
5. Belt conveyor
6. Belt conveyor
7. Hand picking belt
8. Slat conveyor
9. Coarse grinding mill
10. Chain conveyor
11. Mixing and screening machine
12. Belt conveyor
13. Belt conveyor with travelling tripper
14. Window turning machine
15. Window aeration system
16. Belt conveyor
17. Magnetic separator
18. Control box
19. Belt conveyor
20. Screening machine
21. Belt conveyor
22. Belt conveyor
23. Destoner
24. Belt conveyor
25. Belt conveyor
26. Cyclone plant
27. Sewage sludge storage tank
28. Sludge pump

A Receiving hopper
B Sewage Sludge storage tank
C Rejects from picking belt
D Fine rejects
E Coarse rejects
F Rejects (iron)
G Rejects
H Stone and glass container
J Fine compost

# GARBAGE COMPOSTING

## Description

The composting facility consists essentially of the following parts, viz. (i) automatic piling installation for the primary windrows; (ii) Windrow turning machine; and (iii) covered compost area (shed), which can be provided with aerating and moisturing equipment. The composting plant consists of coarse treatment line and refining line.

## Advantages

- Hygienic and dust-free, reliable process;
- Uniform and homogenous compost:
- Low Investment;
- Low operational cost

## Areas of Application

Municipal and domestic waste recycling. Organic agricultural fertilizers

## Stage of Development

Commercialised in Austria

## Inputs Required

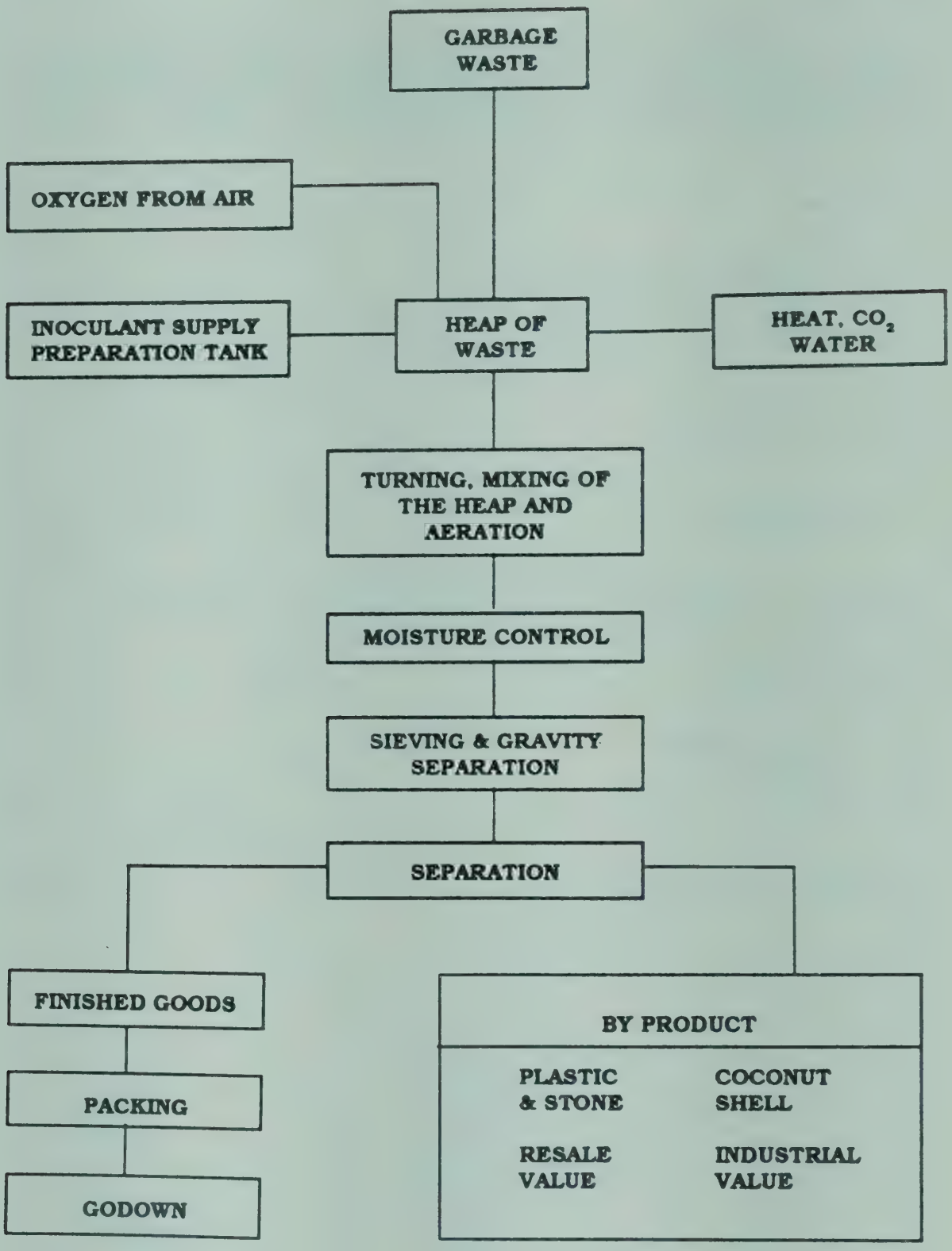
*Equipment/machinery* : US$ 30,000

*Operational cost* : US$ 100,000/year

## Terms of Transfer

Joint venture; Investment

*Contact* : A. NEUHOLD, NEUHOLD, GESELLSCHAFT M.B.H., UMWELTTECHNISCH ANLAGEN, A-8200 GLEISDORF, WEIZER STR, 49, AUSTRIA ☐ TELEPHONE : 03112/4057 ☐ TELEX : 312069 ☐ FAX : 03112/4320


GARBAGE WASTE
OXYGEN FROM AIR
INOCULANT SUPPLY PREPARATION TANK
HEAP OF WASTE
HEAT, $CO_2$ WATER
TURNING, MIXING OF THE HEAP AND AERATION
MOISTURE CONTROL
SIEVING & GRAVITY SEPARATION
SEPARATION
FINISHED GOODS
PACKING
GODOWN
BY PRODUCT
PLASTIC & STONE
COCONUT SHELL
RESALE VALUE
INDUSTRIAL VALUE

FLOW SHEET

# ORGANIC FERTILIZER FROM AGRICULTURAL WASTES

## Description

Production of organic fertilizer by composting agricultural wastes, particularly sugarcane trash, at optimum controlled conditions. The process involves aerobic biodegradation of trash of prescribed size under controlled conditions of moisture, C/N, temperature and pH.

## Advantages

Waste utilization;

Improvement of soil fertility;

Low operational cost;

Cost-effective product.

## Areas of Application

Agriculture.

## Stage of Development

commercialised in The Philippines.

## Inputs Required

Raw materials : Agricultural wastes

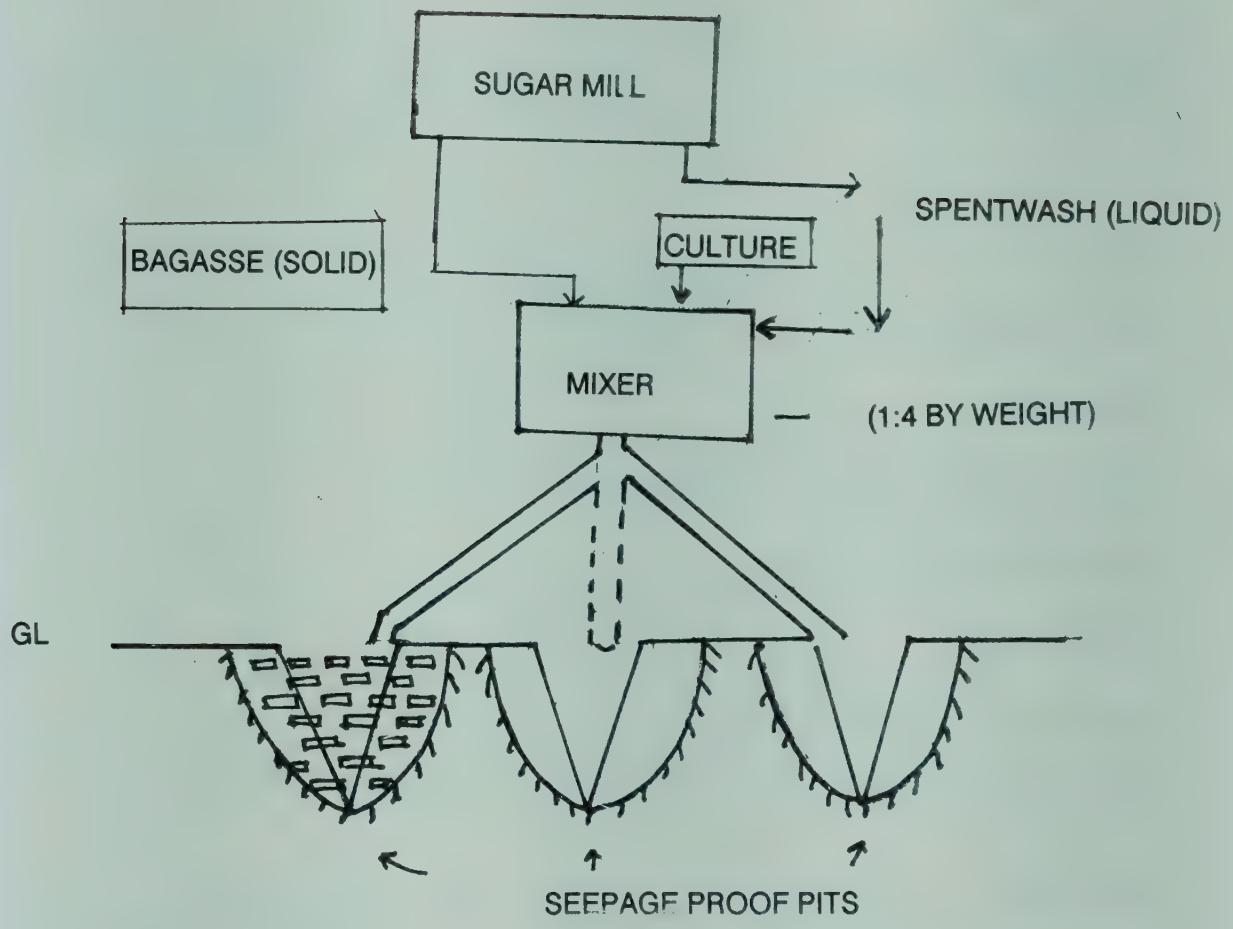
## Project Cost

Negotiable

## Terms of Transfer

Turnkey, licensing, subcontracting, joint venture, investment.

*Contact* : CASIANO S. ABRIGO, JR. DEPT OF CHEMICAL ENGINEERING, COLLEGE OF ENGINEERING AND AGRO-INDUSTRIAL TECHNOLOGY (CEAT), UNIVERSITY OF THE PHILIPPINES AT LOS BANOS (UPLB), LAGUNA 4031, THE PHILIPPINES


SUGAR MILL
SPENTWASH (LIQUID)
CULTURE
BAGASSE (SOLID)
MIXER
(1:4 BY WEIGHT)
GL
SEEPAGE PROOF PITS

# ORGANIC WASTE COMPOSTING

## Description

The spent wash (vinasse) having a BOD concentration of 90,000 mg per litre or more is mixed with bagasse in specially prepared composting pits with the help of specially designed mechanical equipment. It is established that a loading of 1:4 (bagasse : spent wash on weight to weight basis) can be achieved over a period of 15 days. The compost prepared has the following characteristics C/N - 1.5: 1, N-2 - 2.5%, P-0.5 - 0.7% and K-3.5 - 4%, moisture - 40 to 45%.

## Advantages

Entire process takes only 2 weeks whereas other established methods take 8 to 12 weeks.
Since the process is carried into seepage-proof pits, no separate stacking is necessary.
No possibility of any ground and surface water pollution.
Pay back period is 2 years as compared to 5 years in other processes.

## Areas of Application

Agro-based industries.

## Stage of Development

Pilot Plant

## Production Capacity

30,000 MT/year [for distillery of 30 Kl/day alcohol capacity]

## Inputs Required

*Raw Materials* : Bagasse, spent wash press mud [if required] and specially developed culture.
*Utilities* : Power - 15 kWh/ton of compost produced; Others - Diesel: 0.5 litre/ton of compost produced
*Required Area* : Outdoor - 50,000 sq.m.
*Manpower* : Skilled - 7; Unskilled - 15

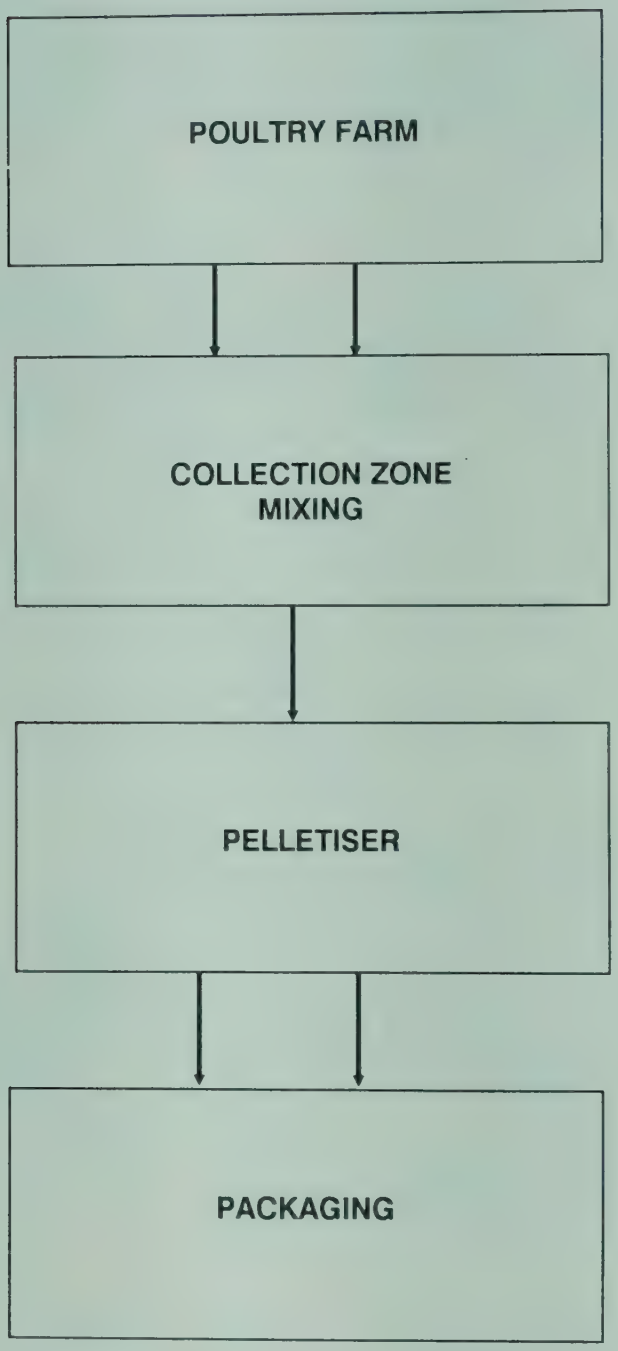
## Project Cost

*Equipment/Machinery* : US$ 500,000
*Operational cost* : US$ 150,000/year
*Fee for Technical Know-how/Training* : US$ 40,000

## Terms of Transfer

Technical know-how, Licensing

*Contact* : B. SUBBA RAO, ENVIRONMENTAL PROTECTION RESEARCH FOUNDATION, "ARUNDHATI", NEAR MSEB, VISHRAMBAG, SANGLI 416415, MAHARASHTRA STATE, INDIA




PROCESS FLOW DIAGRAM

## POULTRY WASTE PELLETING PROCESS

### Description

This is a process for converting layer manure into fertilizer pellets of 3mm size.

### Advantages

Since it involves only dry manure, the process reduces pollution normally associated with poultry farms.
Converts waste into a storable, transportable, valuable organic fertilizer.

### Areas of Application

Agro industry, fertilizer industry.

### Stage of Development

Patented and commercialized in Australia

### Production Capacity

3 to 4 tonnes/hour

### Inputs required

*Raw materials* : Poultry wastes
*Utilities* : Power - around 150 HP
*Manpower* : Skilled - 1, Unskilled - 2 or 3;

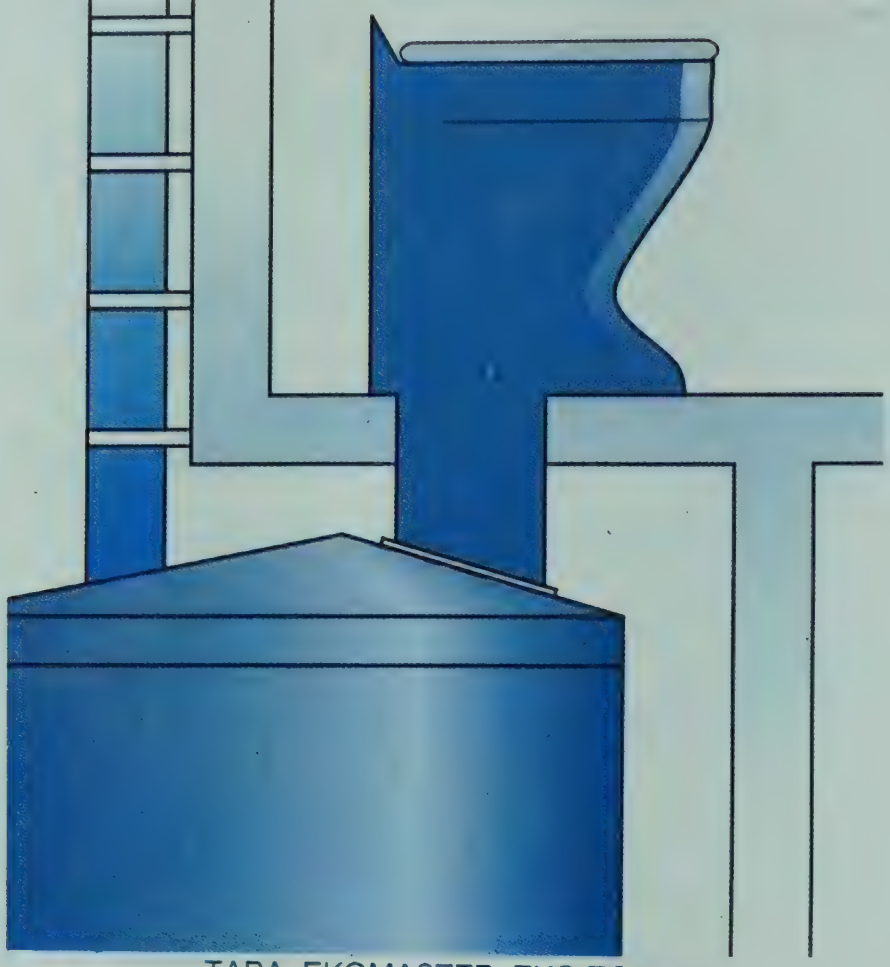
### Project Cost

*Equipment and machinery* : US$ 400,000
*Operational cost* : US$ 224,000/year

### Terms of Transfer

Licensing

*Contact* : PHILIP GIBSON PTY LTD, G.P.O. BOX 3723, SYDNEY, NSW 20001, AUSTRALIA



TARA EKOMASTER EKO-TOILET

TARA TERMO 450 LITRE COMPOSTOR

# URINAL SYSTEMS USING BIOLOGICAL COMPOSTING METHODS

## Description

Ecora Oy produced the TARA brand of compostors and composting toilets. The composting is started in Termo Compostor (normally 450 litres suitable for the family) and composted to humus. Composting is a simple step towards reducing waste. It can be used as part of a system including separation of different types of waste and recycling of materials. By composting we treat some of our own waste, save transport costs and produce soil nutrients.

## Advantages

- Economical and odour-free, suitable for mobile homes and holiday chalets and other buildings in areas with out access to running water; Functional and unobtrusive, blending in naturally with any garden setting; Well-designed, efficient compostor that will last a long time - a worthwhile, long term investment; The compost (organic fertilizers) produced can be used in agriculture.

## Areas of Application

- Mainly rural areas where conventional sewage systems are unavailable; Suitable for mobile homes and holiday chalets; Toilet for summer homes; Compst (organic fertilizer produced can be used in agriculture.

## Stage of Development

TARA products were developed in Finland with Finnish conditions in mind, but they function equally well in other parts of the world. Sweden, Portugal and Nigeria are among the countries where TARA products are in use. In 1991 ECO-Toilets were installed in the public toilets at a beach in portugal. TARA Eko-Toilets have functioned very well in Nigeria and fit in with the local culture. Now over 10,000 units are in use. TARA Termo 450 compostor, Ekomaster, TARA Eko-Toilets, Ekomatic, Ekomini are some of the varieties of TARA toilet.

*Materials* : TARA toilet is made of durable semipliable polyethene plastic which is very strong and can withstand extreme variations of temperature. The composting compound container is of galvanized steel.

*Shape* : A round structure,the most effective for composting. There are no cold corners, where the process works more slowly.

*Size* : 450 litres, suitable for the average family :

| | Ekomatic | Ekomini | Ekomaster |
|---|---|---|---|
| Width: | 620 mm | 400 mm | 320 mm |
| Depth: | 820 mm | 520 mm | 520 mm |
| Height: | 530/800 mm | 400/600 mm | 430 mm |

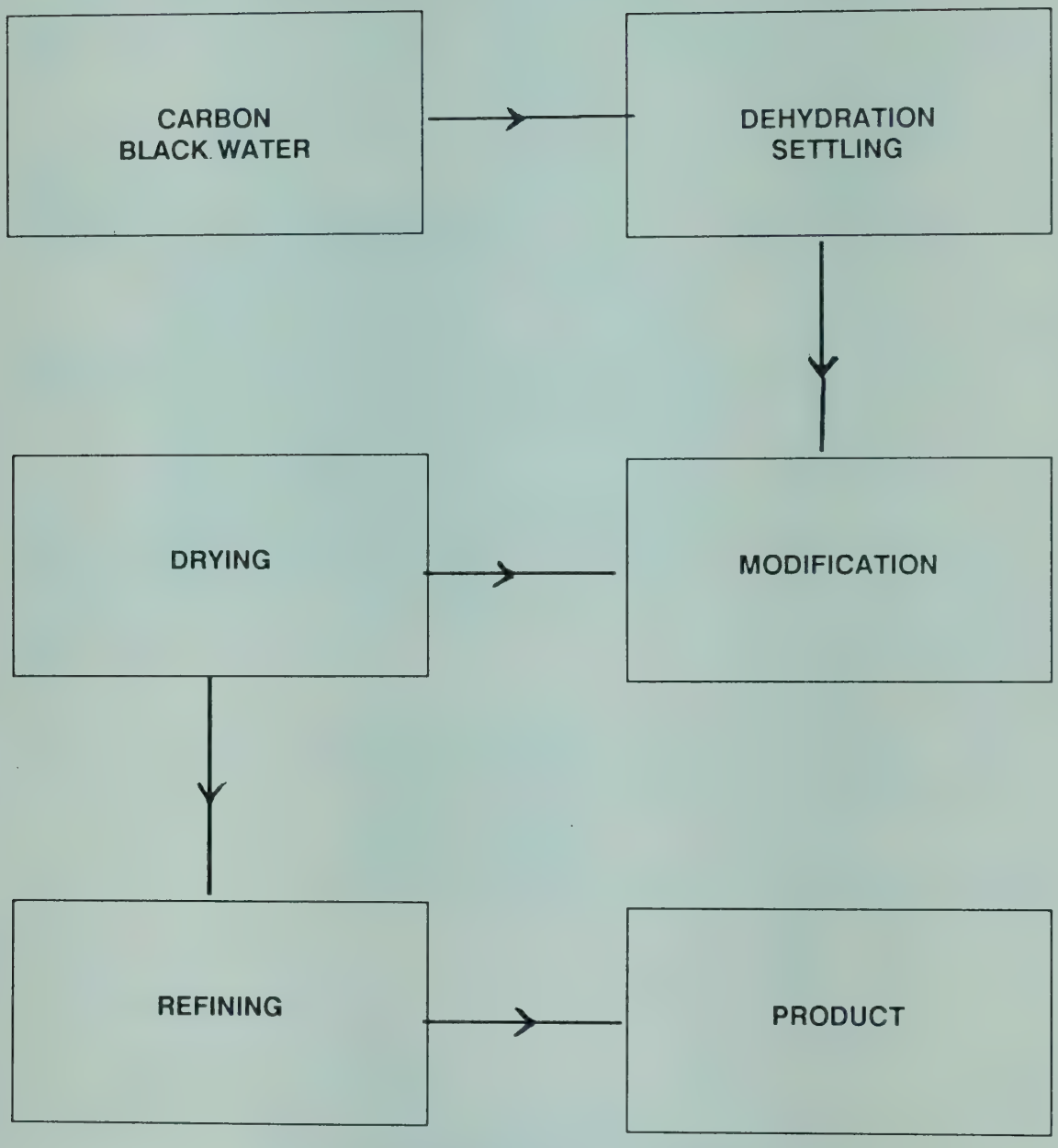
## Special Features

The insulation material is with in a double plastic wall, protecting it from damp, ants and implements used to turn the compost; The compostor at convenient height; The compostor has a base which ensures it retains the moisture in the waste for a longer period; The base also prevents nutrients from escaping into the soil; A ventilation pipe conveys gases and air produced in the composting process outside the building; The toilet has a filter boox treating liquids during periods when the toilet is in heavy use.

## Terms of Transfer

Negotiable

*Contact* : OY ECORA-SF LTD. ARHIPANPOLKU 2A. SF-00420 HELSINKI, FINLAND ☐ TELEPHONE : +358-0-507 2400 ☐ FAX : +358-0-507 2409




PROCESS FLOW DIAGRAM

## CARBON BLACK FROM FERTILIZER INDUSTRY WASTES

### Description

This new type of carbon black is prepared from the wastes from fertilizer manufacturing factories by chemical modification. The process involves settling, dehydration, drying, making necessary modifications, refining and packing the fuel product.

### Advantages

Waste utilization.
Simple process.
Low investment.
Saves water.

### Areas of Application

Fertilizer, chemical and electrical industries

### Stage of Development

Patented and commercialised in China

### Inputs Required

*Raw materials* : Wastes from fertilizer industry - carbon black liquor
Utilities : Power :300 KWH/Ton

| PROPERTY | CSF-II | CSF-III |
|---|---|---|
| Special surface area, $m^2/g$, > | 200 | 230 |
| Oil absorption, ml/g | 1.4 - 1.7 | |
| Hydrochloric acid absorption, ml/g > | | 2.8 |
| Specific insulation resistance, K .cm < | | 31 |

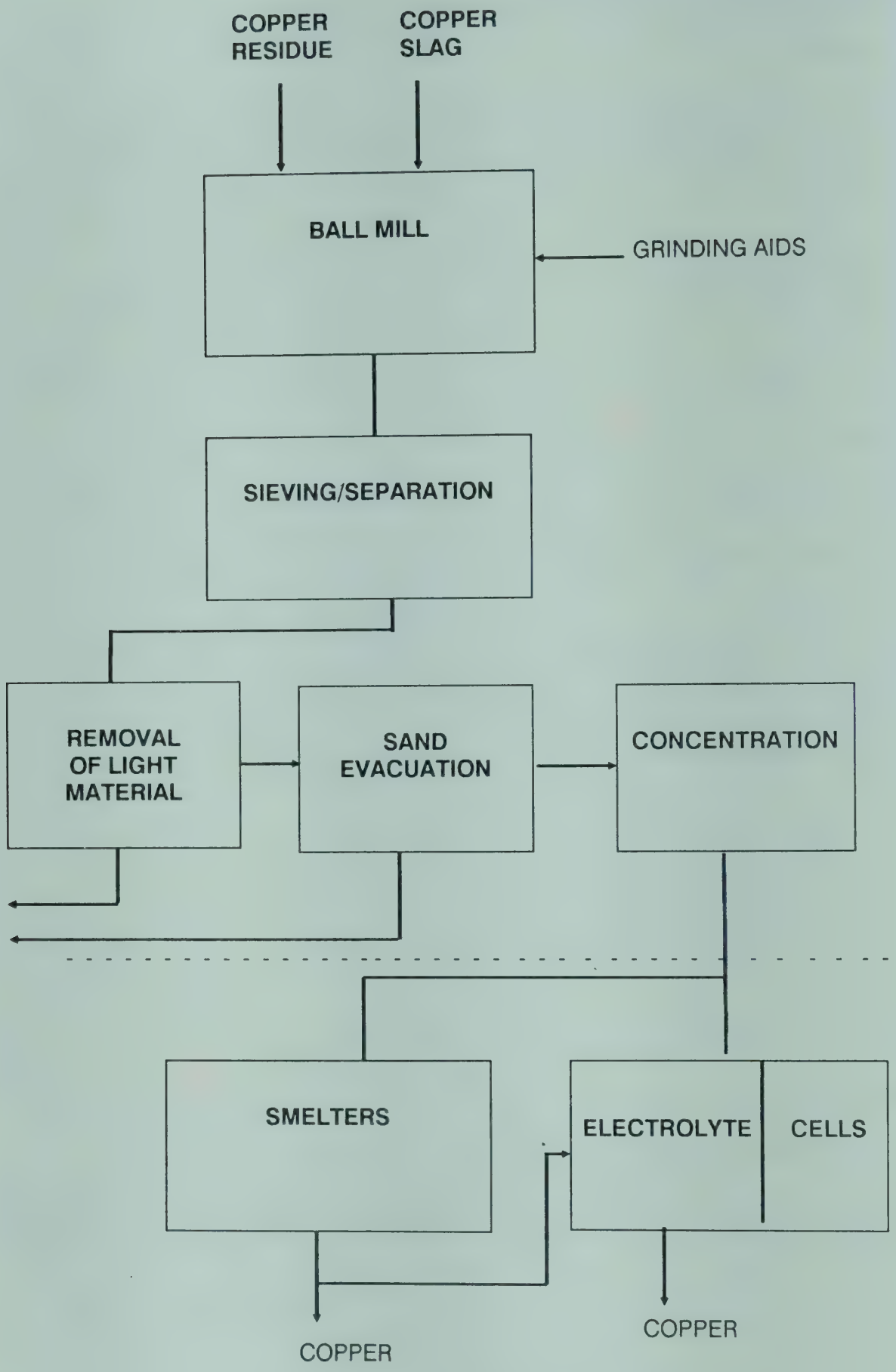
### Project Cost

*Know-how fee* : US$ 200,000

### Terms of Transfer

Know-how; licensing; turnkey

*Contact* : SUN JIANXIN, CHINA TECHNOLOGY MARKET MANAGEMENT AND PROMOTION CENTRE (SINOTECHMART), 15A FUXING ROAD, P.O. BOX 199-7, BEIJING 100 036 CHINA (P.R) ☐ TELEPHONE : 86 1 8015015 ☐ TELEX : 22349 SSTCC CN ☐ FA X : 86 1 8016894




PROCESS FLOW DIAGRAM

## COPPER EXTRACTION FROM WASTE COPPER RESIDUE

### Description

This is a process technology for the recovery of copper from waste copper residues, smelted copper slag, etc. The process facility comprises ball mill, classifier, table, floating machine and sand pump. The process yields 500-600 t of copper from 5,000 to 6,000 t of waste residues. The grades of copper recovered vary from12 to 15%.

### Advantages

Industrial waste utilization and manufacture of value-added products.
Cost-effective technology

### Areas of Application

Metallurgical, casting, machining industries.

### Stage of Development

Commercialised in China since 1975.

### Production Capacity

500-600 t/annum of copper from 5,000 to 6,000 t/annum of waste residues.

### Inputs Required

*Raw materials* : copper residues
*Utilities* : Power - 654,000 KWH/annum, Water-20,000 to 24,000 litre/annum, others -Coal - 750-900 t/annum;
*Required Area* : Building - 1,500 sq.m.; Land - 1,500 sq.m.
Manpower : Skilled - 3, Unskilled - 36

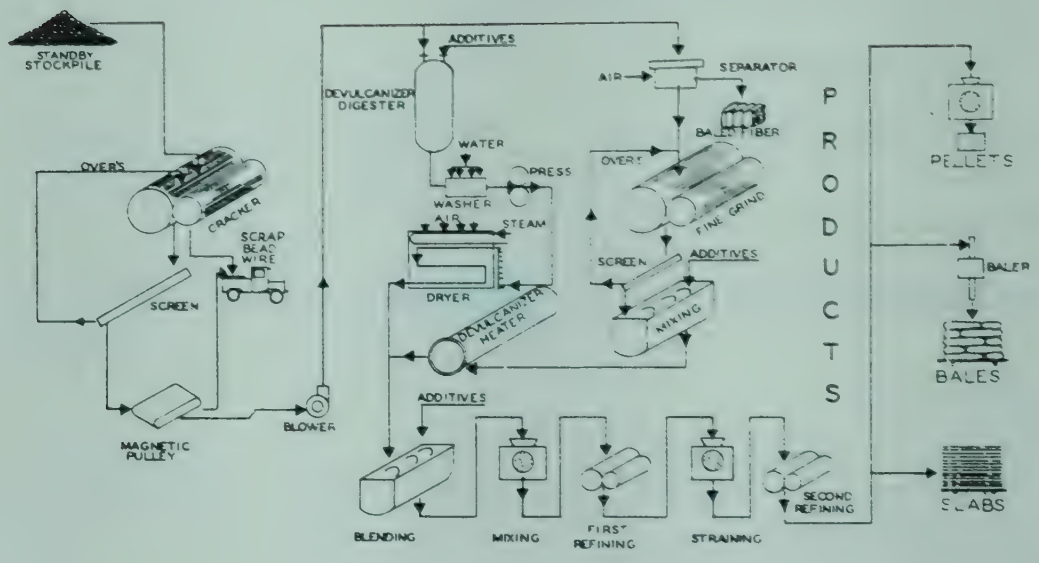
### Project Cost

*Equipment/machinery* : US$ 500,000
*Operational cost* : US$ 120,000 to 140,000/year

### Terms of Transfer

Turnkey

*Contact* : CHENLIN, BEIJING ASSOCIATION FOR COMPREHENSIVE UTILIZATION OF RESOURCE, NO. 1A, XI XIAO ST., CHONGWENMEN, BEIJING 100051, CHINA (P.R.) ☐ TELEOHONE : 513351




FLOW DIAGRAM

## RECLAMATION OF RUBBER FROM USED RUBBER PRODUCTS

### Description

A technique for reclaiming rubber from waste tyres, rubber boots and other rubber-based products using water digestion process.

### Advantages

Waste utilization and manufacture of value-added products.
Promotion of cleaner environment.
Efficient use of natural resources.

### Areas of Application

Reused as a raw material in the rubber industry.

### Stage of development

Commercialised in China in 1987

### Production Capacity

3,500 tons/year

### Inputs Required

*Raw materials* : Waste rubber - 4,760 tons/year; chemicals - 507 tons/year
*Utiities* : Power or fuel : Electricity - 42.8 kWh/hr, Coal-800 kg/hour, Water - 96 cubic meter/hour
*Required Area* : Building - 5 439 sq.m., Land - 2,076 sq.m.
*Manpower* : Skilled - 60, Unskilled - 56

### Project Cost

*Equipment/machinery* : US$ 565 million
*Fee for technical know-how/training* : US$ 450,000
*Operational cost* : US$ 1.13 million/year

### Terms of Transfer

Turnkey

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*Contact* : HA HONG YUE, MANAGER, DEPARTMENT OF TECHNOLOGY TRADE DEVELOPMENT, TIANJIN FOREIGN TRADE CORPORATION, 59, NANJING ROAD, TIANJIN 300050, CHINA (P.R) ☐ TELEPHONE : (022) 317543 ☐ TELEX : 234117 TFTC CN ☐ FAX : (022) 314339

RECYCLING PROCESS AND APPARATUS FOR USED FLUOR LAMPS

# RECYCLING PROCESS AND APPARATUS FOR USED FLUORESCENT LAMPS

## Description

In this process, used fluorescent lamps are first broken under liquid seal. The broken glass material and the attached phosphor particles which are both mercury-contaminated is washed in a liquid (mostly water) under mechanical agitation. The phosphor is sedimented in a separate container or separated by a centrifuge. The end-caps of the lamps are sieved out or magnetically separated from the glass material. The concentration of mercury at the end of the process is about 1.0 mg/kg glass.

## Advantages

Simple process. No need for filters for the exhaust air. More than 95% of the weight of the lamps can be recycled. All types of fluorescent lamps can be recycled. Environmentally safe.

## Areas of Application

Decentralized recycling centres in order to prevent toxic airborne contamination.

## Stage of Development

Commercialised in Germany

## Production Capacity

Recycling of 5 million used lamps per year

## Inputs Required

*Raw materials* : Used fluorescent lamps; *Utilities* : Power - 30 KW; Water : 50 lt/hour
*Required Area* : Building - 100 sq.m., Land - 200 sq.m; *Manpower* : Unskilled-2

## Project Cost

*Equipment/machinery* : US$ 225,000; *Operational cost* : US$ 120,000/ yr

## Terms of Transfer

Licensing; subcontracting

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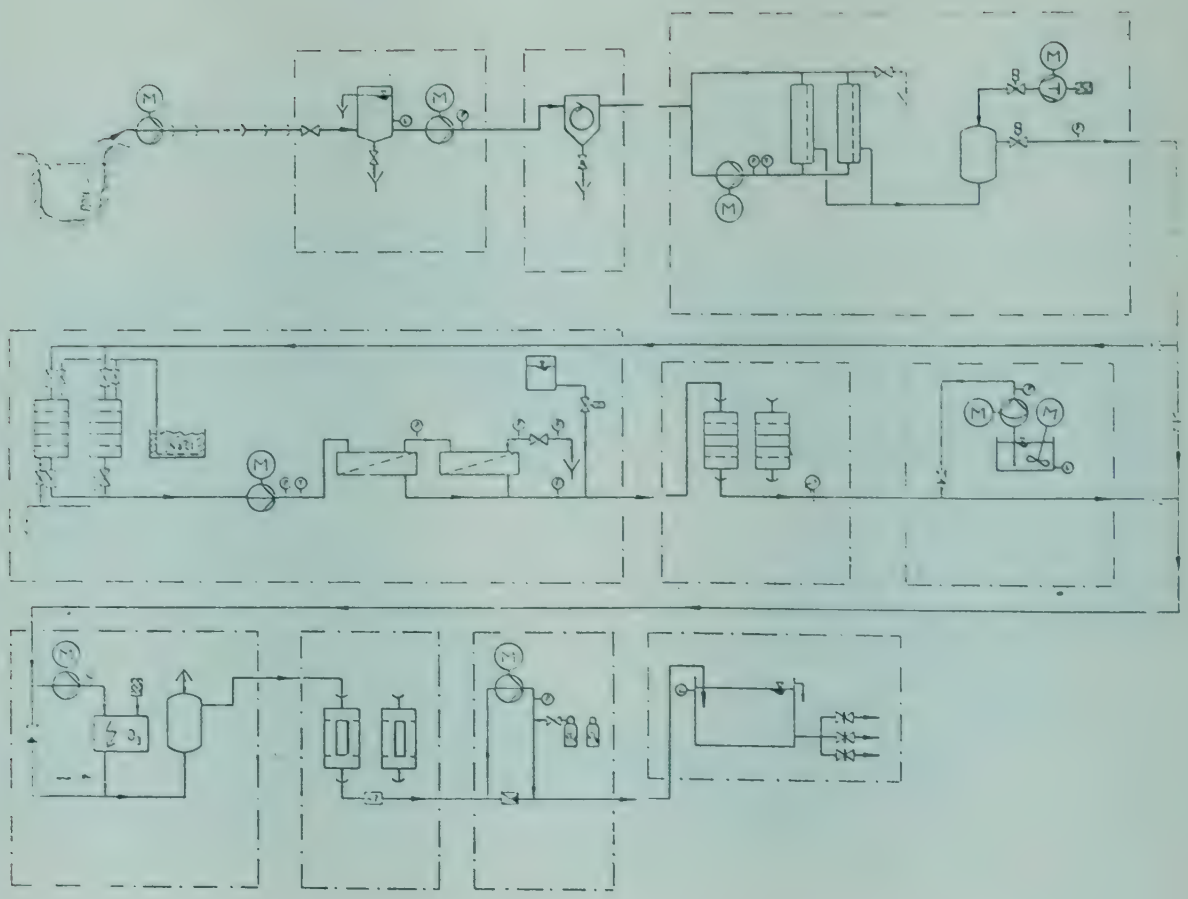
*Contact* : KURT REUTER, C/O. PHYSIK + DATENTECHNIK GMBH, HEROLDSBERGER WEG 5, D-8500 NURNBERG 10, GERMANY ☐ TELEPHONE : 0049-911-521-69-99 ☐ FAX : 0049-911-521-69-98



WATER DECONTAMINATION SYSTEM

## ABC WATER DECONTAMINATION SYSTEM

### Description

The ABC plant has been developed by GRIA Technische Handels- und Planungs-Ges.m.bH. with a view to produce drinking water by decontamination of water of any kind, by a combination of various process stages.

Development of the system producting drinking water from (atomic-biological-chemical) contaminated water (ABC TWAA system) has been supported to a great extent by the Institute of General Biology, Biochemistry and Biophysics of the faculty of Natural Sciences of the University of Salzburg, and by the Austrian Research Centre of Seibersdort.

### Advantages:

Fast and efficient operations, no need for expensive and frequently faulty water analysis (for both raw and treated water).

Inter casting physical processes, resulting in higher cleaning values than conventional processes, e.g. in case of contamination with certain nuclides (ABC system: 99.3% to 99.9%, compared with about 50% to 70% in conventional system).

Treatment of water with nuclear, biological and / or chemical contamination by means of one compact plant, without lengthy preparation and adjustment work.

Compact design for instant use in the event of accidents and disasters. Designed for easy transportation, weights and dimensions within international road and railway standards.

No expert personnel required. After easy adjustment the plant produces drinking water from water.

Easy and low-cost operation and maintenance.

Universal use in day-to-day ground water treatment, in detoxication of leachate, and cleaning of industrial waste waters with varying contamination.

### Areas of Application

Water supply (if normal supply is interrupted).

Drinking water supply in special situations (if normal supply is not available).

Ground water treatment, ground water protection.

Separation of contaminants (from water for treatment in special dumping sites).

### Stage of Development

Patented in Austria. Patents have been applied for in Europe, and patent applications in the US are in course.

### Size:

Width : 2.2 m; Height :2.3 m; Length : 3.9 m

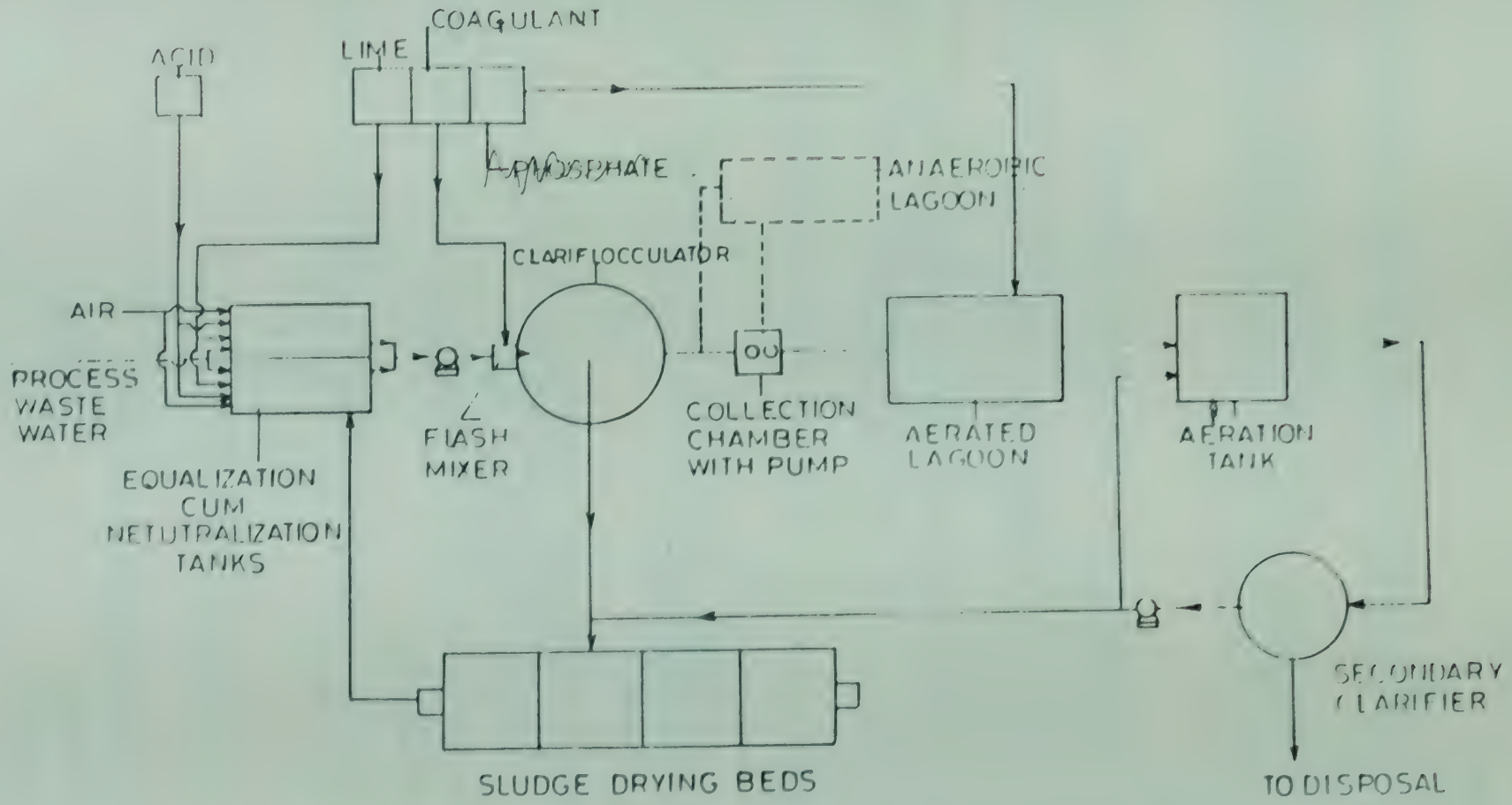
### Inputs

Electricity : 20 kw for a 3000 l/h compact plant.

### Terms of Transfer

Commercialised

*Contact* : GRIA AUSTRIA GES.M.B.H. A-5020 SALZBURG. AUSTRIA




FLOW DIAGRAM FOR THE LIQUID EFFLUENTS TREATMENT PLANT

# ANAEROBIC-AEROBIC ORGANIC WASTE WATER TREATMENT

## Description

The factory adopts alkaline method to produce cotton-pulp which ensures 6,000 t/year. At the same time, it also brings about plenty of thick and black liquid and acid-alkaline-neutral waste water, for which the organic substance concentration is very high. The anaerobic-aerobic treatment undertakes advance and deep treatment measures.Main equipments are pipe line anaerobic reactor and JB-3 air-borne reactor. After treatment, the main quality index of the waste water will be : CODor350mg/1 BOD5100mg/1; ph-7; ssÂmg/1.

## Advantages

The key equipment is modern
Low consumption of electric energy, saving operational cost
Operation process is simple and efficient
Biogas, a sub-product, can be re-used
Cost of treatment is cheap

## Areas of Application

Light and textile, food and pharmaceutical industries

## Inputs Required

*Raw materials* : Alkaline organic waste water with high concentration
*Utilities* : Power - Capacity of assembled generator - 554.92kw using 409.90kw
*Required Area* : Indoor - 1566 $m^2$

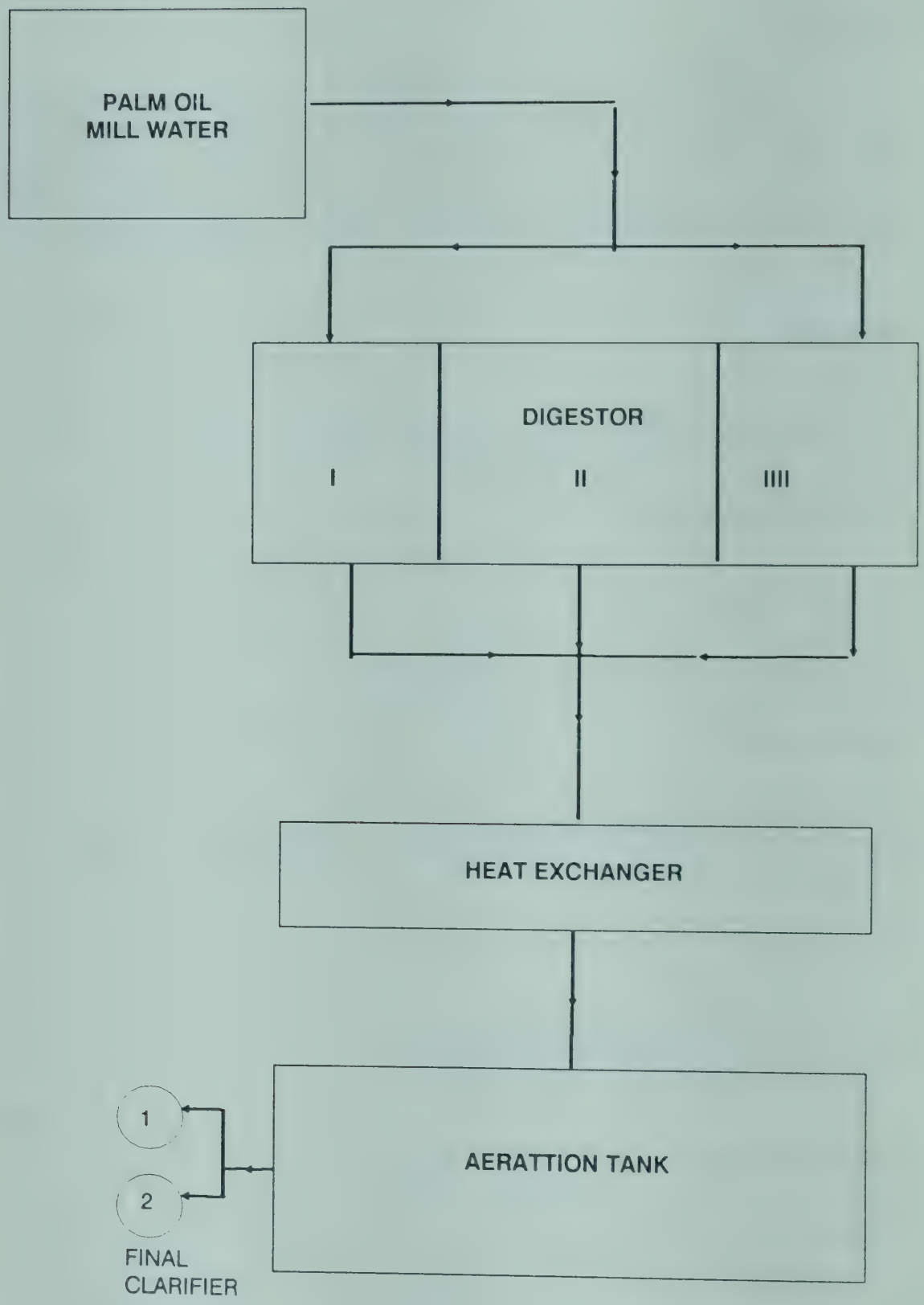
## Project Cost

*(Excluding land and building)* : 493,9700 Yuan
*Equipment/Machinery (FOB)* : Yuan 153,4600
*Operational cost for one year* : Yuan 49,7200

## Terms of Transfer

Investment

*Contact* : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245




FLOW DIAGRAM

## ANAEROBIC WASTE WATER/EFFLUENT TREATMENT PLANT

### Description

This is a versatile biological primary/first stage treatment process. The process makes use of contact anaerobic digestion and is presently being used in the treatment of palm oil mill effluents.

### Advantages

- Economically viable for the treatment of high-concentration wastes.
- Recovery of valuable energy from agricultural wastes in the form of methane for direct use in industrial processes for heat and/or electricity generation.
- By-product of biomass for use as soil conditioner/fertilizer.
- Energy efficient technology.
- Cost effective technology with savings in electricity generation and profit from fertilizers.

### Areas of Application

Food and fertilizer industry

### Stage of Development

Pilot plant

### Production Capacity

20 to 2,000 cub.m. digester

### Inputs Required

*Raw materials* : Organic and agro industrial waste water effluent
*Required area* : Land - 8,094 sq.m.
*Manpower* : Skilled -2, Unskilled - 1

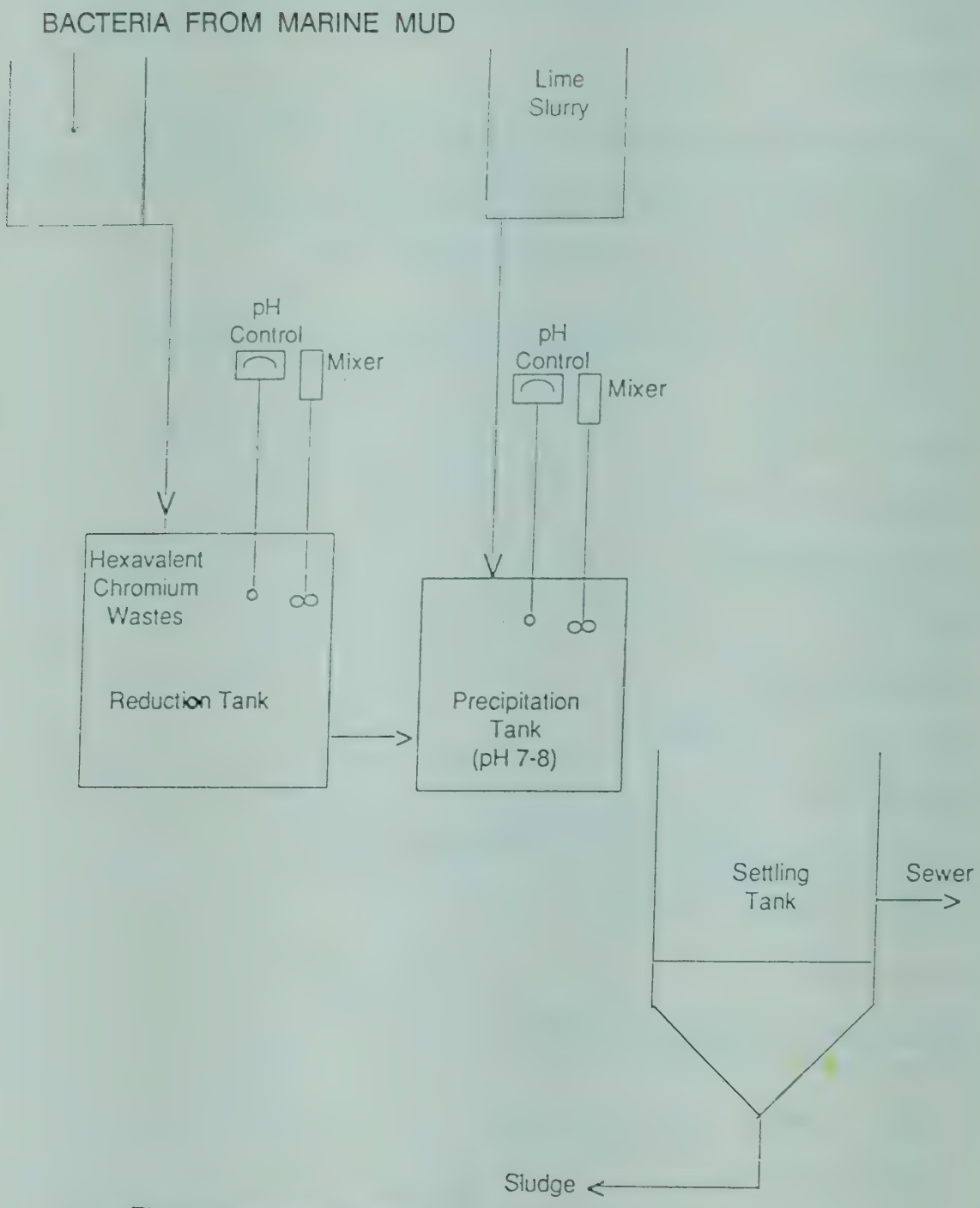
### Project Cost

*Equipment/machinery* : US$ 1,200,000
*Operational cost* : US$ 30,000/year

### Terms of Transfer

Joint Venture, Turnkey

*Contact* : MARKETING AND BUSINESS DEVELOPMENT UNIT, STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA (SIRIM), P.O. BOX 7035, 40911 SHAH ALAM, SELANGOR DARUL EHSAN, MALAYSIA
☐ TELEPHONE : 5592601 ☐ FAX: (603) 5509477




FLOW DIAGRAM FOR THE BATCH REDUCTION OF HEXAVALENT CHROMIUM

# BACTERIAL METHOD FOR PURIFICATION OF CHROMIC INDUSTRIAL WASTE WATER

## Description

A strain of bacteria separated from marine mud is used in this treatment method.

The mechanism of bacterial method is that the hexavalent chrome (chromate or bichromate) is reduced to the three valence chrome [$Cr(OH)_3$] precipitates from the domestic sewage, and that purifies the hexavalent chromic wastes.

## Advantages

Easy method.
Low investment and operational costs.

## Areas of Application

Treatment/purification of all industrial waste waters containing chromate or bichromate.
Electroplating industries.

## Stage of Development

Commercialised in China

## Inputs Required

*Raw materials* : Pseudomonas - strain of bacteria.

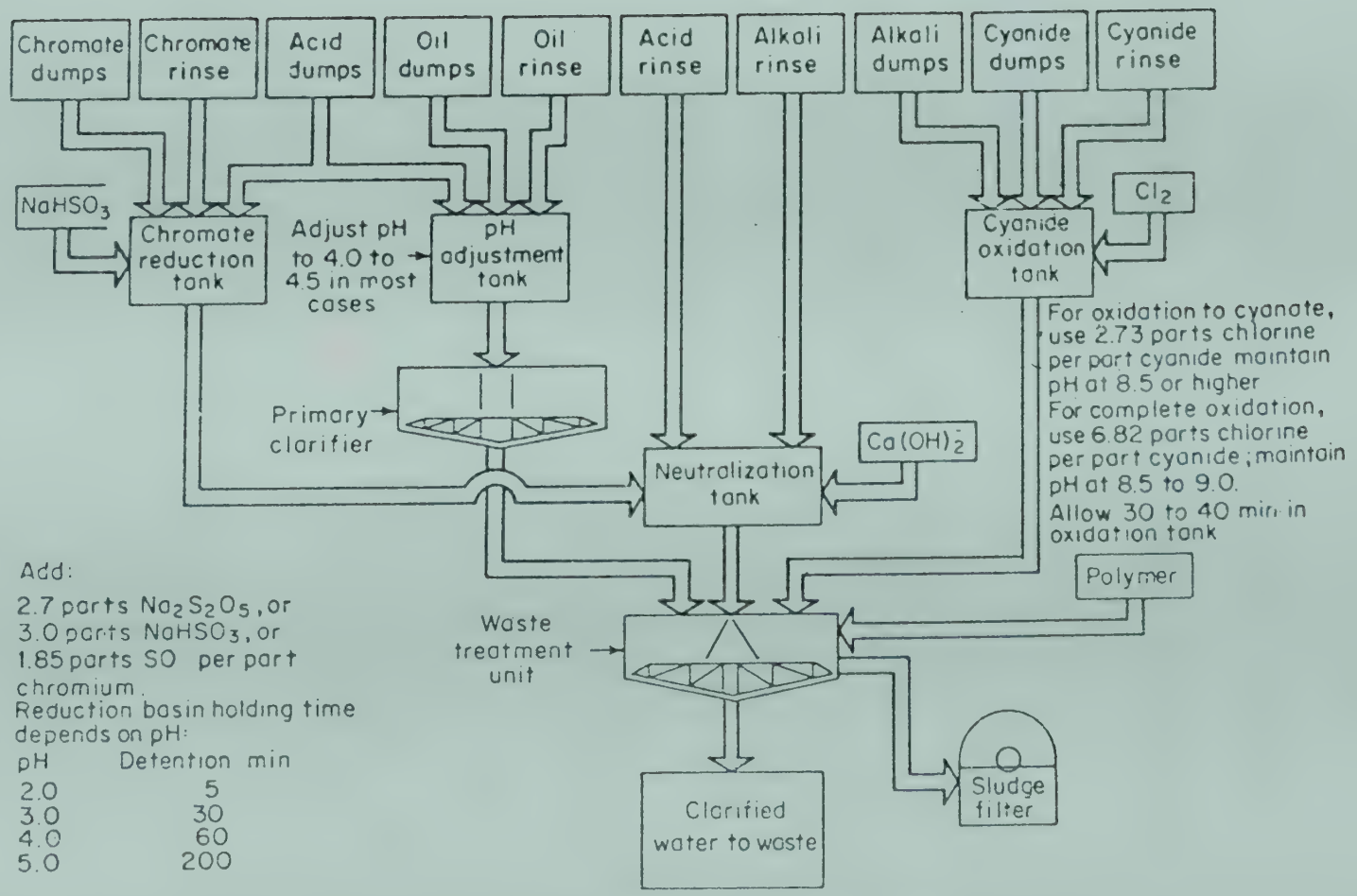
## Project Cost

*Technology transfer fee* : US$ 50,000.

## Terms of Transfer

Licensing, Subcontracting, Turnkey

*Contact* : CHINA TECHNOLOGY MARKET MANAGEMENT AND PROMOTION CENTRE (SINOTECHMART) 15 FUXING ROAD, P.O. BOX 199-7, BEIJING 100 036, CHINA (P.R) ☐ TELEPHONE : 86 1 8015015 ☐ TELEX : 22349 SSTCC CN ☐ FAX : 86 1 801689




TYPICAL FLOW DIAGRAM

## CHROME-PLATING WASTE WATER TREATMENT

### Description

The technology uses acid luminous Cu to replace cyanide used in traditional copper-plating process and prevents the pollution of cyanide. It also uses luminous Ni-Fe, luminous Ni and may save 10-20% of Ni, an advanced active technology to strengthen cyanide used in the combining force between plating layers, and uses waste active matter to treat the chrome plating waste water, and prevent electroplating pollution. Technical specifications are: CASS test : 24h; Combining strength = 12%; Smooth finish: 590-606; Thickness of plating layers: Cu 15, Ni-Fe 14, Cr 0.5; (Cr8+) in the discharged waste water: 0.5mg/L.

### Advantages

Easy to compound electroplating
Fast depositing of metal ion
Good performance of equal plating
Wide areas of application
Low production cost
High efficiency
Non-pollutant

### Areas of Application

To protect and decorate surface of metal or non-metal.

### Stage of Development

Patented in China since 1992.Commercialised in China since 1992

### Inputs Required

*Raw materials* : Cu and Ni - abcut 6.3T, chemical material - 35T to electroplate 50,000$m^2$ products a year
*Utilities* : Power - 3 CkWh/annum; Water - 4300T/annum; Coal - 350T/annum
*Required area* : Indoor - 400$m^2$; Outdoor - 100$m^2$

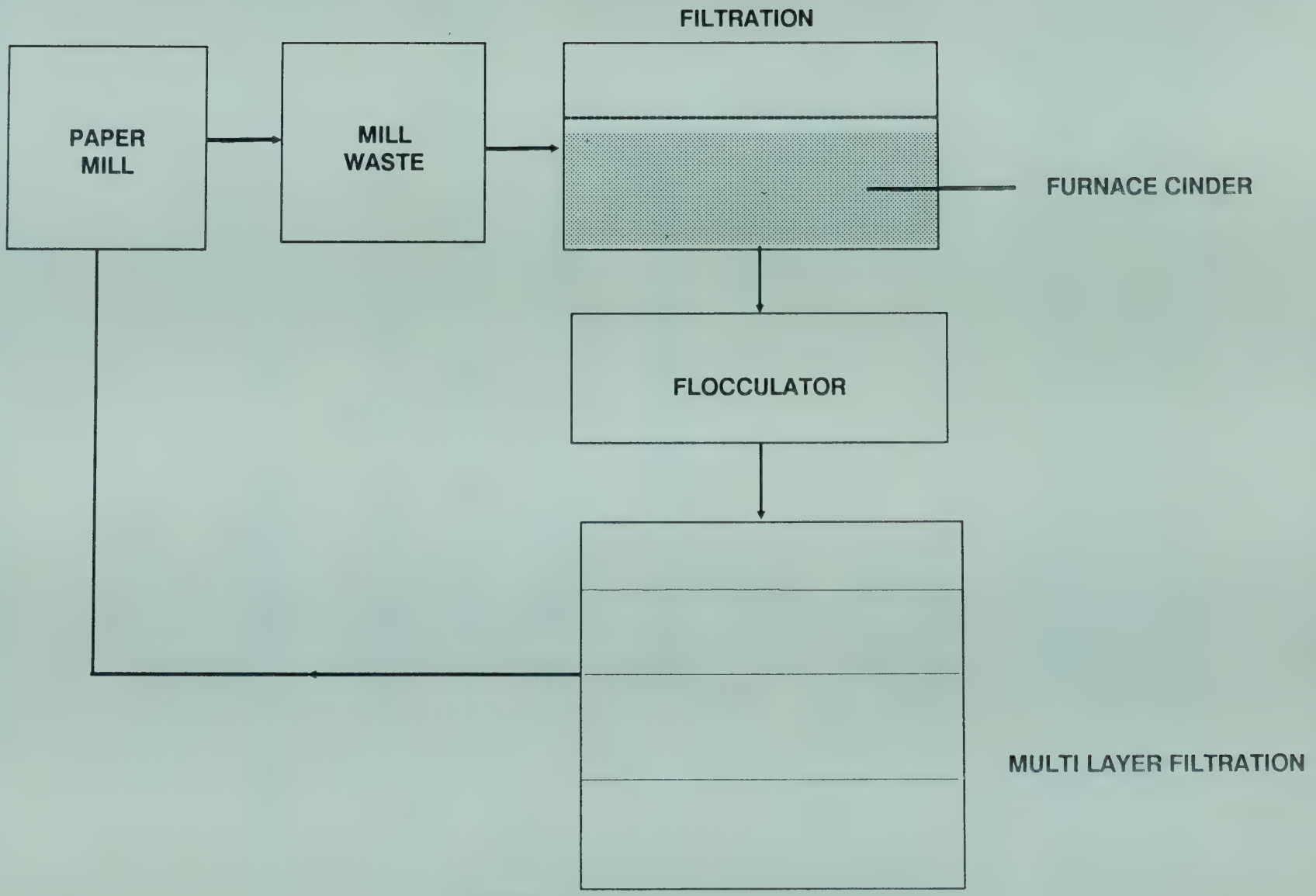
### Project Cost

*Equipment/Machinery (FOB)* : US$200,000
*Operational cost for one year* : US$20,000

### Terms of Transfer

Sub-contracting

*Contact* : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245




CLOSE CIRCUIT WATER SYSTEM

# CLOSED CIRCULATING WATER SUPPLY SYSTEM IN PAPER MILLS

## Description

The key of the technology is in disposing waste water discharged from paper mills using regenerated pulp with the principle of filtration in furnace cinder, flocculation, precipitation and multi layer filtration. The quality of the cycling water can meet the water standard of paper making and the water having been disposed can be reused as production water. The closed circulation of water supply in paper making can be carried out.

## Advantages

No waste water discharge
Saves a great quantity of water resource. Water supply per ton of paper can be decreased from more than 200 to less than 20 tons
Saving investment. The investment of the disposal system is only about 50% of the steam floatation process
The cost of disposal process is much lower than others and the system is very convenient for operation.
The disposal system is very effective and the water from it is in accordance with the water standard of paper making.

## Areas of Application

Paper making industry with regenerated pulp

## Stage of Development

The technology has won the first prize of Science and Technology Progressive Award. Created first in China, it has been used in four paper mills with the regenerated pulp in China.

## Inputs Required

*Raw materials* : Flocculant - 0.2-10 gm/ton of waste water
*Required area* : Indoor - 100-500 $m^2$; Outdoor - 200-500 $m^2$

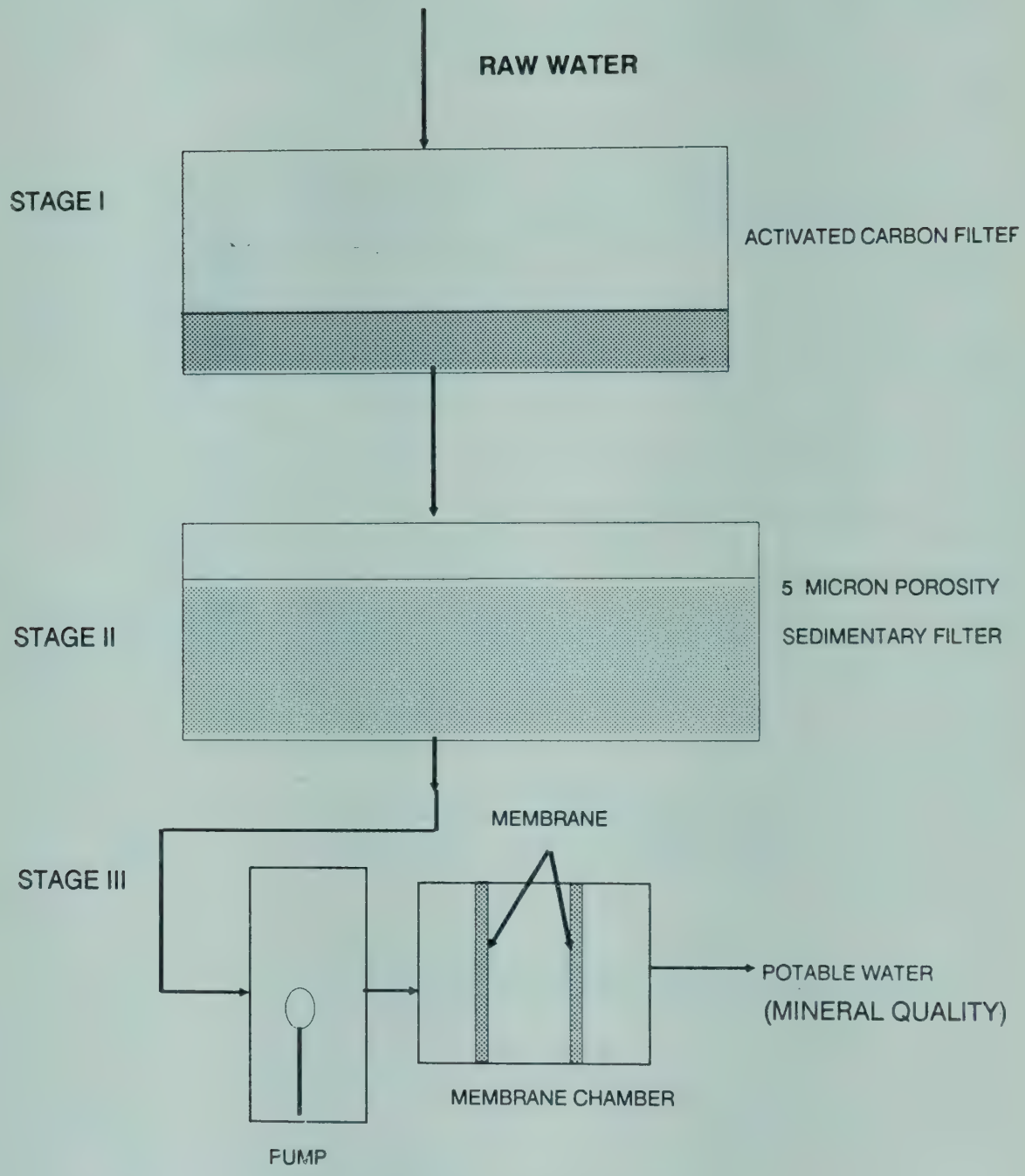
## Project Cost

*Excluding land and building* : US$200,000 - 1,000,000
*Operational cost for one year* : US$100,000 - 500,000

## Terms of Transfer

Sub-contracting, Turnkey

Contact : MR. ZHAO FENG, DIRECTOR OF FOREIGN AFFAIRS DIVISION, NATIONAL INFORMATION CENTRE OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY, BEIJING 100835, PEOPLE'S REPUBLIC OF CHINA ☐ TELEPHONE : 8393934 ☐ FAX : 8393245




TYPICAL PROCESS STAGES

## 'NANOSMOSI' HOME WATER TREATMENT SYSTEM

### Description

This is a system for converting potable water into mineral water by NANOSMOSI process. The process consists of three phases. First, the water is treated by absorption by allowing it to pass through an activated carbon pre-filter, then it is filtered through a 5 micron porosity sediment filter and, finally, through a special membrane. The first two phases operate using feed water pressure. The third phase uses pressure from the pump inside the apparatus to force 25% to 30% volume of water through the special membrane.

### Advantages

Retains 30% natural mineral state of water.
Nearly 100% bacteria-free and heavy metal free.
A different type of membrane could be used for water with 2,000 ppm/TDS and above.

### Areas of Application

For making tap water safe for drinking and giving it a mineral quality. For offices and schools, restaurants, bars, hotels, etc.

### Stage of Development

Commercialised in Italy, UAE, Saudi Arabia and the Philippines.

### Production Capacity

5000 pcs/year

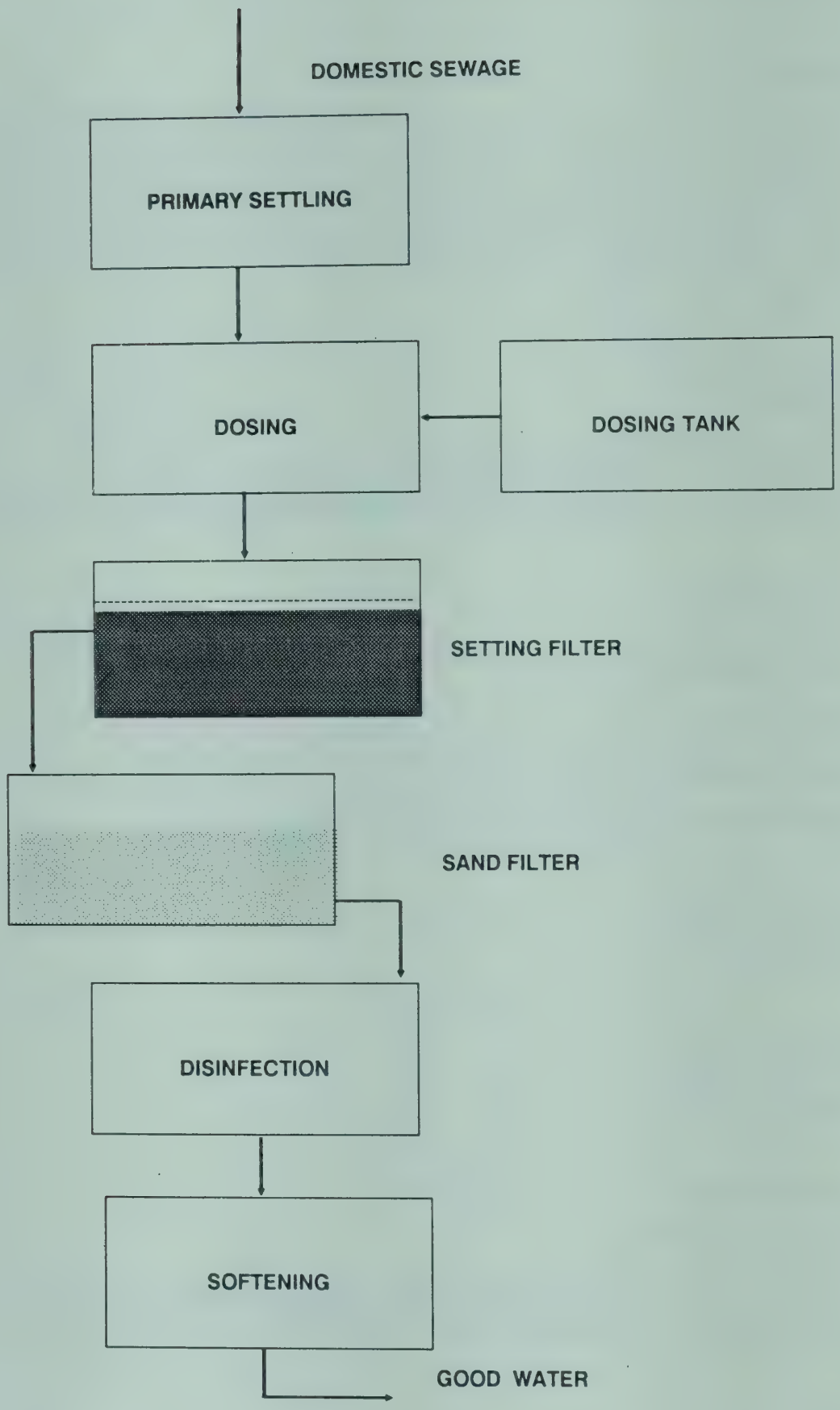
### Inputs Required

*Manpower* : Skilled-20

### Terms of Transfer

Joint venture, licensing

*Contact* : MONICA NEPOMUCENO, INTERNATIONAL MARKETING EXECUTIVE, S.I.D.E.A. ITALIA S.R.L. VIA PIETRO MASTRI 24, FLORENCE 50135, ITALY ☐ TELEPHONE : (055) 609 313 ☐ FAX: 0039-55-611 511




TYPICAL PROCESS STEPS

# PACKAGE PLANTS FOR RECLAMATION AND REUSE OF WATER FROM DOMESTIC SEWAGE

## Description

The treatment process utilizes the proven modification of the activated sludge process known as extended aeration. The technique utilizes biological treatment of sewage followed by settling, sand filtration and disinfection. Additional treatment (e.g. softening) is incorporated where justified by end-users of the reclaimed water. Three sizes of package plants are available for sewage flow of 50 cu.m./day, 100 cu.m./day, 150 cu.m./day. Larger sizes may be fabricated to order.

## Advantages

Modular in construction.
Easy to transport and install.

## Areas of Application

Treatment for all types of waste water, both industrial and municipal

## Stage of Development

Commercialised in India

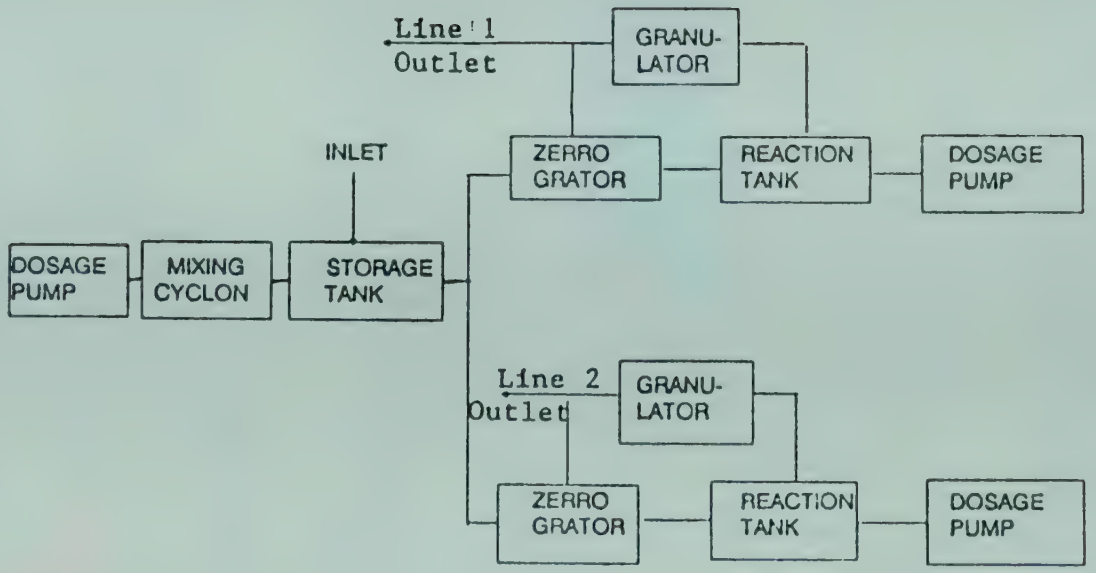
## Inputs Required

*Raw materials* : Chemicals for sewage treatment and disinfection
*Manpower* : Skilled-2, Unskilled-2

## Terms of Transfer

Licensing, subcontracting, turnkey

Contact : SOLI J. ARCEIVALA, ASSOCIATED INDUSTRIAL CONSULTANTS (INDIA) PVT. LTD, 13TH FLOOR, RAHEJA CENTRE, NARIMAN POINT, BOMBAY 400 021, INDIA




BLOCK DIAGRAM

## WASTE WATER TREATMENT PLANT

### Description

The plant is mainly meant to disinfect water of bacteria. It has compact construction, with two parallel working reactor tanks, which treats the water by direct steam heating at a temperature of 90°C. The process is computer controlled and the plant is secured against letting out untreated water with high virus and bacterial content. Four different disinfection methods are employed, viz. (i) heat treatment of the waste water as a whole; (ii) direct chlorinating of all waste water; (iii) sludge separation, chlorinating and heat treatment of the sludge; and (iv) treatment by wave pressure combined with chlorinating.

### Advantages

System is totally enclosed, thus eliminating the risk of operators coming into contact with the infected water.
Completely eliminates all disease-causing bacteria.
Fully automatic, modular in construction and has variable capacity.
Compact, easy to install and operate.
Reliable process.
Low operational cost.

### Areas of Application

Hospitals, industrial laboratories, veterinary/medical institutions, quarantine plants and military and civilian R&D centres.

### Stage of Development

Commercialised in Sweden

### Project Cost

For complete plant around US$ 350,000

### Special Features

Onflowing waste water is collected in a buffer tank built in sections of steel plate and provided with strong inner gumming

Both vertical and horizontal construction are possible

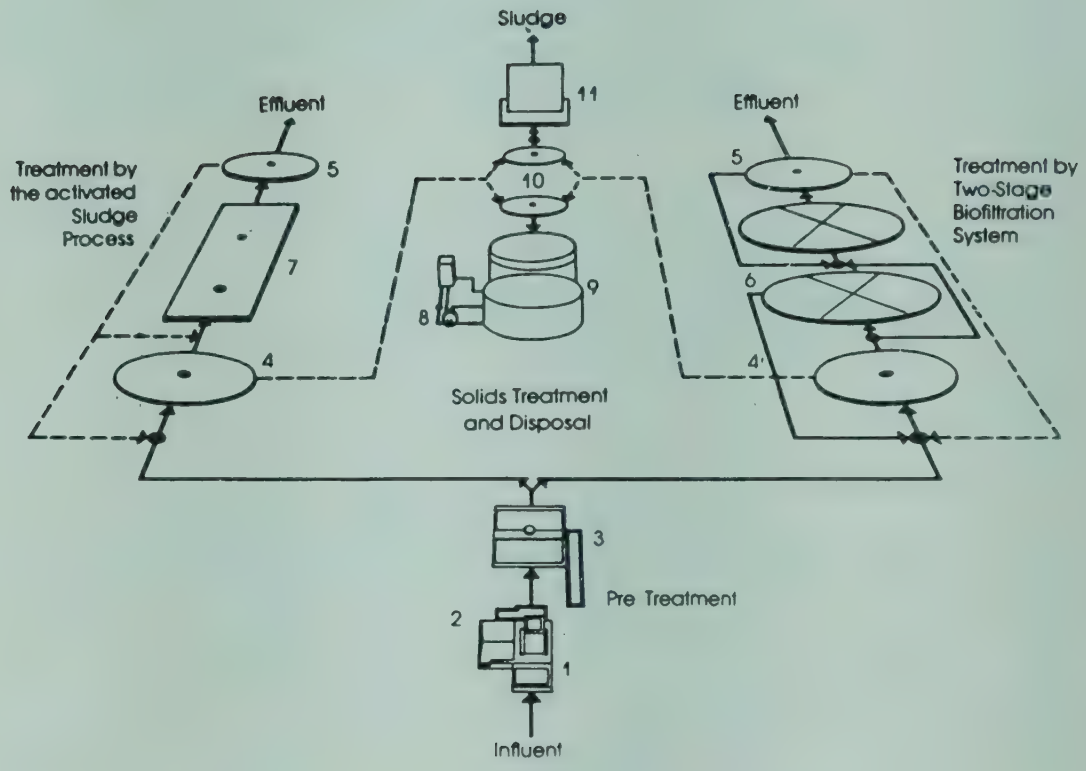
Disinfection treatment of discontinuous filling is made possible by means of pneumatically controlled valves

The automatic control of the process is done from a separate switch board provided with flow schedule and the necessary time watches, breakers, etc.

### Terms of Transfer

Licensing

*Contact* : MARTIN JOHANSSON, NORDINDUSTRI AB, BOX 144, 952 22 KALIX, SWEDEN




FOR PRE-TREATMENT

1. Screening
2. Comminuting
3. Degritting
4. Sedimentation

FOR SECONDARY TREATMENT

5. Secondary Sedimentation
6. Trickling Filtration

For ACTIVATED SLUDGE

7. Aeration

FOR SOLIDS HANDLING

8. Pumping
9. Sludge Digestion
10. Sludge Thickening
11. Sludge Filtration

MULTIPLE EFFLUENT TREATMENT SYSTEM

## WASTE WATER AND SEWAGE TREATMENT PLANTS

### Description

The range extends from compact, pre-fabricated systems and custom-built units to special purpose components such as : screens, circular grit chambers, scrapers of all kind, agitators for sludge thickeners, aeration equipment, sludge handling plants and accessories of all kinds, e.g. air lift pumps, inlets, overflow metal plants, slides, etc.

### Advantages

Low investment and operational and utility costs.
Cost-effective technology.

### Areas of Application

Sewage and waste water treatment

### Stage of Development

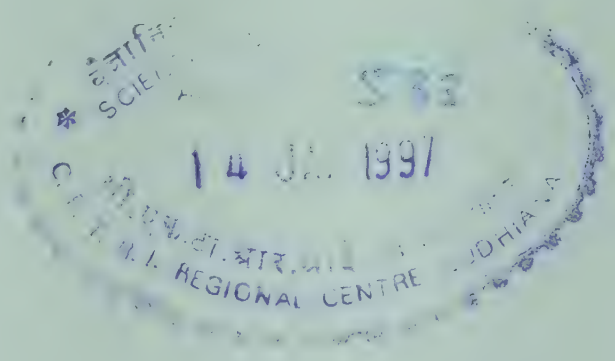
Commercialised in Austria

### Project Cost

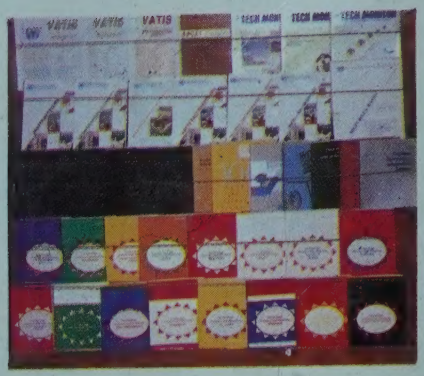
All other details including project cost are available on request.

### Terms of Transfer

Licensing




*Contact* : ALOIS NEUHOLD, NEUHOLD GESELSCHAFT M.B.H ENVIRONMENTAL PROTECTION TECHNOLOGY, WEIZER STRASSE 49, A-8200 GLEISDORF, AUSTRIA ☐ TELEPHONE : 03112/40-57 ☐ TELEX : 312069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ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY

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